YOUR HOME ON WHEELS

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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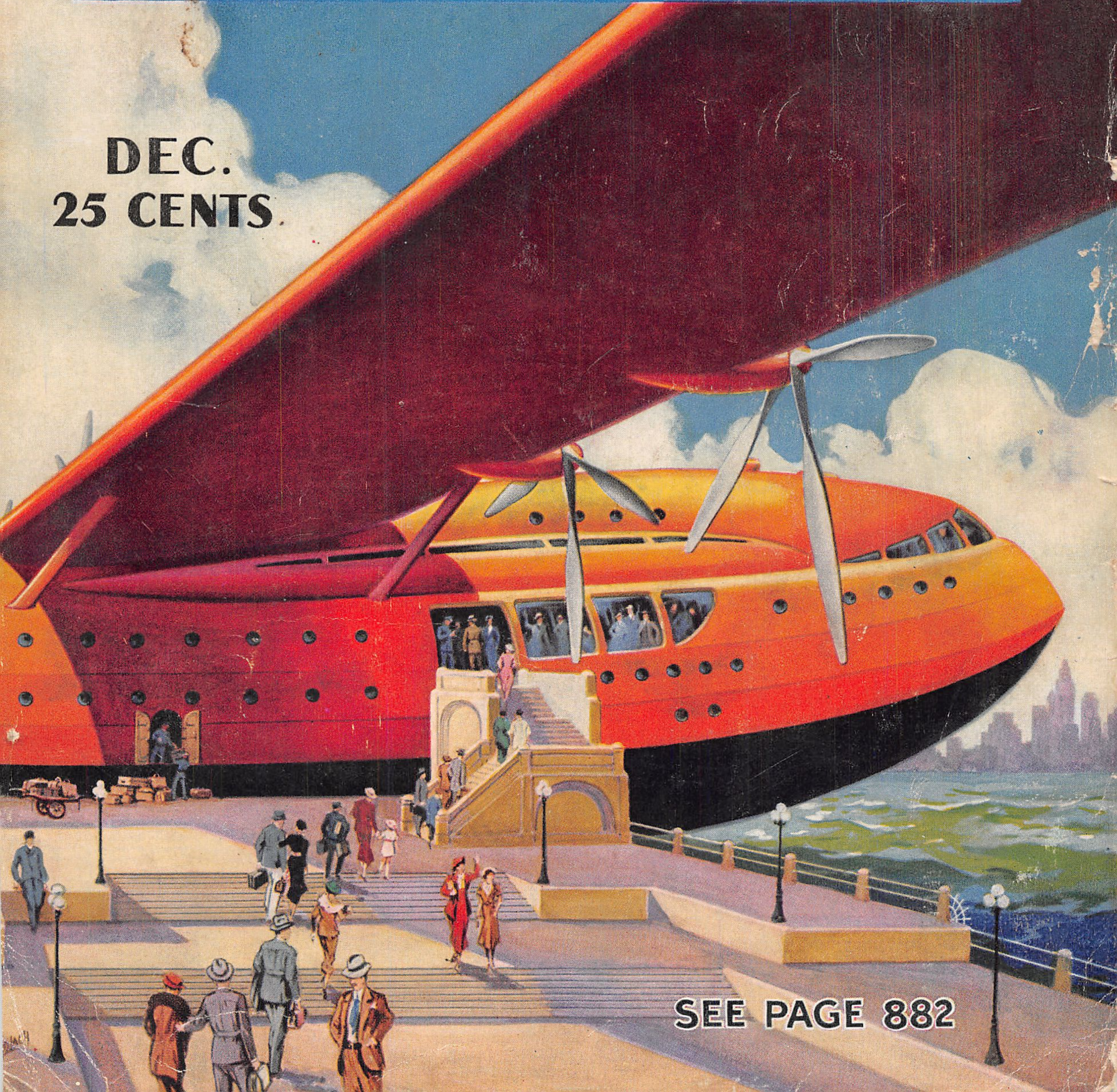

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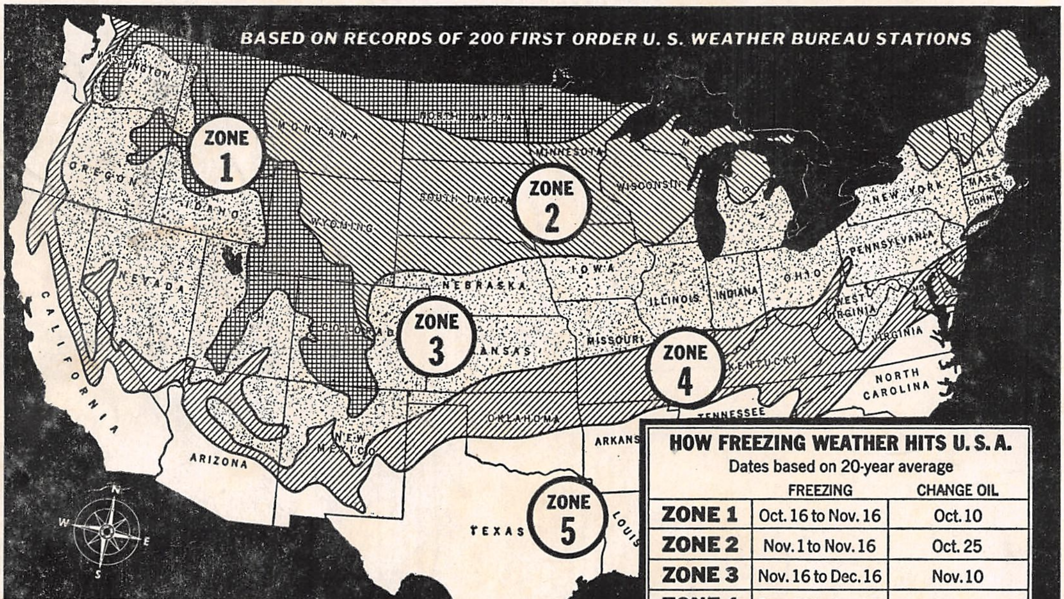
SEE PAGE 882

MOBILOIL ARCTIC WINTER MAP

TELLS YOU WHEN TO CHANGE YOUR OIL FOR QUICK STARTING


BASED ON RECORDS OF 200 FIRST ORDER U. S. WEATHER BUREAU STATIONS
ZONE 1
ZONE 2
ZONE 3
ZONE 4
ZONE 5
WASHINGTON
OREGON
IDAHO
MONTANA
NORTH DAKOTA
MINNESOTA
SOUTH DAKOTA
WYOMING
WISCONSIN
NEVADA
UTAH
COLORADO
NEBRASKA
IOWA
ILLINOIS
INDIANA
OHIO
PENNSYLVANIA
NEW YORK
MASS.
CONN.
N.H.
VT.
MAINE
WEST VIRGINIA
VIRGINIA
KENTUCKY
NORTH CAROLINA
TENNESSEE
CALIFORNIA
KANSAS
MISSOURI
OKLAHOMA
ARKANS
ARIZONA
NEW MEXICO
TEXAS
LOUIS
N
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S
W

HOW FREEZING WEATHER HITS U. S. A.
Dates based on 20-year average

	FREEZING	CHANGE OIL
ZONE 1	Oct. 16 to Nov. 16	Oct. 10
ZONE 2	Nov. 1 to Nov. 16	Oct. 25
ZONE 3	Nov. 16 to Dec. 16	Nov. 10
ZONE 4	Dec. 16 to Jan. 16	Dec. 1
ZONE 5	Mild Winter Area	Change Oil Dec. 15

START QUICK—SHIFT EASY

WHEN WINTER STRIKES... be ready with the winter oil millions have proved. Change *now* to Mobiloil Arctic made by the Clearosol Process.

Mobiloil Arctic flows freely—makes starting easy—at low temperatures. Yet it gives full protection under high operating heat.

Get this great, double-range, winter oil today...and protect your gears with Mobiloil Winter Gear Oil. Stop at the nearest Mobiloil dealer's.

SOCONY-VACUUM OIL CO., INC.

Mobiloil Arctic GARGOYLE Mobiloil SOCONY-VACUUM **AND MOBILOIL WINTER GEAR OIL**

Things You Want to Know about the NEW PLYMOUTH

THE BIGGEST, ROOMIEST PLYMOUTH EVER BUILT—New Sound-proofing of Steel Roof and Floor—Shuts Out Road Noises—New Safety Interior—Entire body Pillowed on Live Rubber—Eliminates Vibration and Rumble—New Airplane-type Shock-Absorbers—New "Hushed Ride"—Tests Show 18 to 24 Miles Per Gallon of Gas.

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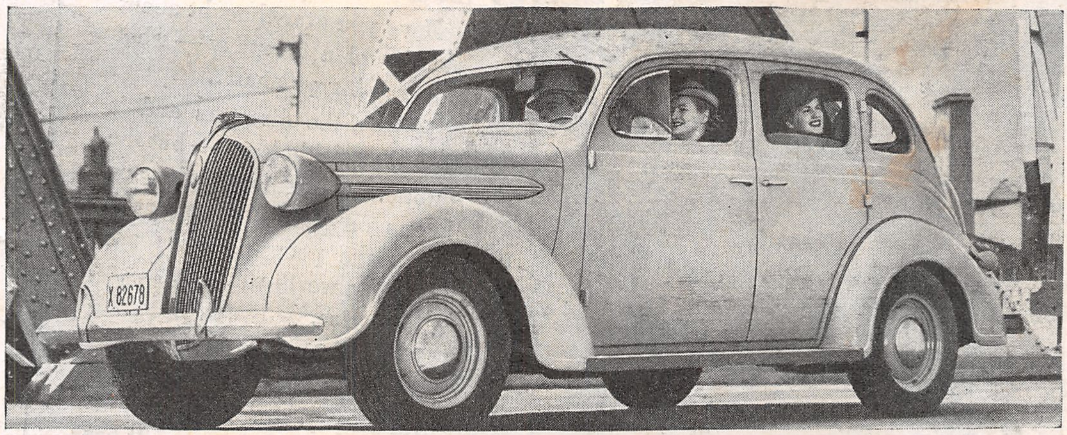
AMAZINGLY BIG... rear seats are 2½" wider... front seats, 3"... more head and leg room, too.



IMPORTANT new developments put Plymouth 'way out in front... make it stand out as the GREATEST VALUE in all Plymouth history! See them.

New Safety Interior... new Scientific Sound-Proofing... new Rubber Cushions between frame and body... new Airplane-type shock-absorbers... new Hypoid rear axle, formerly used in costly cars only... Floating Power engine mountings. It's the longest, widest... biggest... most beautiful Plymouth ever built. PLYMOUTH DIVISION OF CHRYSLER CORPORATION.

EASY TO BUY: Easy terms offered by Commercial Credit Company.

PLYMOUTH BUILDS GREAT CARS

PLYMOUTH *The Best Buy of All Three!*

How long should a Man's legs be?

Lincoln had a good answer. "Long enough," he drawled, "to reach from his body to the ground."

THAT seems like a good rule to apply to a business. It ought to be big enough to do the job it is intended to do.

Have you ever thought about the size of a company — what makes it big or small?

It isn't the directors and it isn't the stockholders — but the public. No business grows, and keeps on growing, unless it meets the people's needs and renders a worth-while service at a fair price.

The Bell System has developed along those lines for over fifty years. It has grown as the nation has grown. It has to be big to provide efficient, adequate telephone service to 127,000,000 people.

AMERICAN TELEPHONE & TELEGRAPH CO. AND ASSOCIATED COMPANIES BELL SYSTEM

BELL TELEPHONE SYSTEM

Popular Mechanics Magazine

H. H. WINDSOR, Founder H. H. WINDSOR, Jr., Editor and Publisher

December, 1936 Vol. 66, No. 6

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The Home That Runs Itself

A FAMILY in Schenectady, N. Y., hires a maid-of-all-work. They call her Handy Annie. Her wages are $2.23 a week. Among a lot of other things, Annie tends the furnace and water heater, turns the clothes washer, runs the ironer, cooks the food, washes and dries the dishes, disposes of the garbage, keeps the house at a comfortable temperature, runs the sewing machine, gets rid of flies and provides music and entertainment on demand. Almost any family could afford a maid who would do all that work for such wages. But where, you ask enviously, could you find another Annie, even if you were heartless enough to work such a simple-minded girl to death? You'll discover the answer next month in "The Home That Runs Itself."

Next Month

WITHIN twenty years, predicts Roger W. Babson, the statistician, more than half of us will be living in automobile trailers. If he is right, you have more than an even chance of calling a trailer your home within two decades. Read the second part of "Hitch Your Wagon to a Car" in January to find just what you can get for your money in a trailer. Eight pages of Coloroto pictures illustrate the story.

The New Casey Jones

WHEN the "City of Denver," crack streamline train, "takes off" from Chicago, it's like the sailing of an ocean liner. The real excitement, however, is in what is still called the engine "cab," although it's more like the front platform of a street car. An article next month takes you on a ride to Denver beside the engineer—or motorman—of a modern streamliner.

Birds of Death

GUARDING Gotham's gates is the job of thirty giant bombers recently delivered to Mitchell Field. With a cruising speed of 210 miles an hour, and carrying a ton of bombs each, these birds of death would form the first line of defense for an air attack on New York City. An article next month tells how the bombers fit into our defense program.

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SIMONIZ

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MOTORISTS WISE
SIMONIZ
HOUSEWIVES DO LIKEWISE

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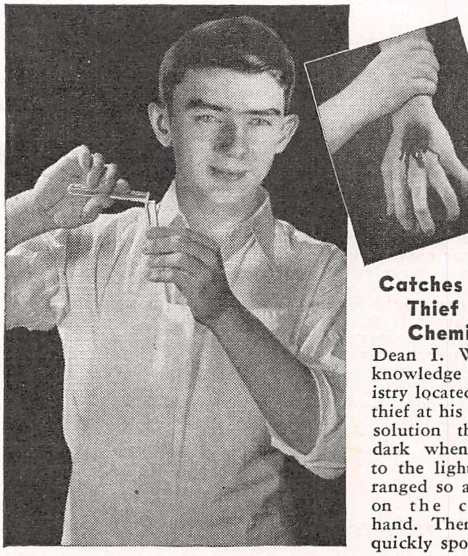
640 THRILLING SCIENTIFIC SECRETS ARE AT YOUR FINGER TIPS

WHEN YOU OWN A NEW GILBERT CHEMISTRY SET



Catches Sneak-Thief with Chemistry

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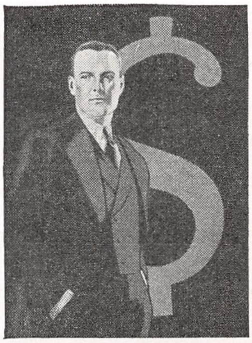

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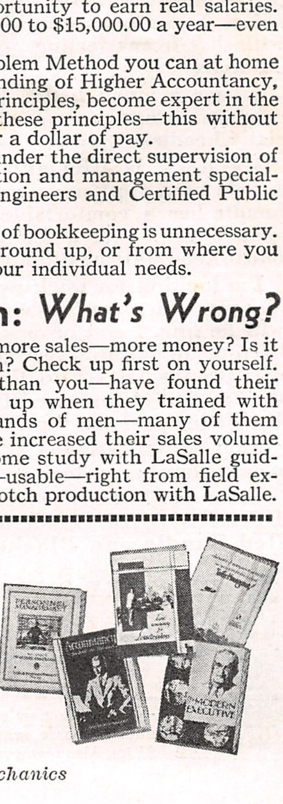

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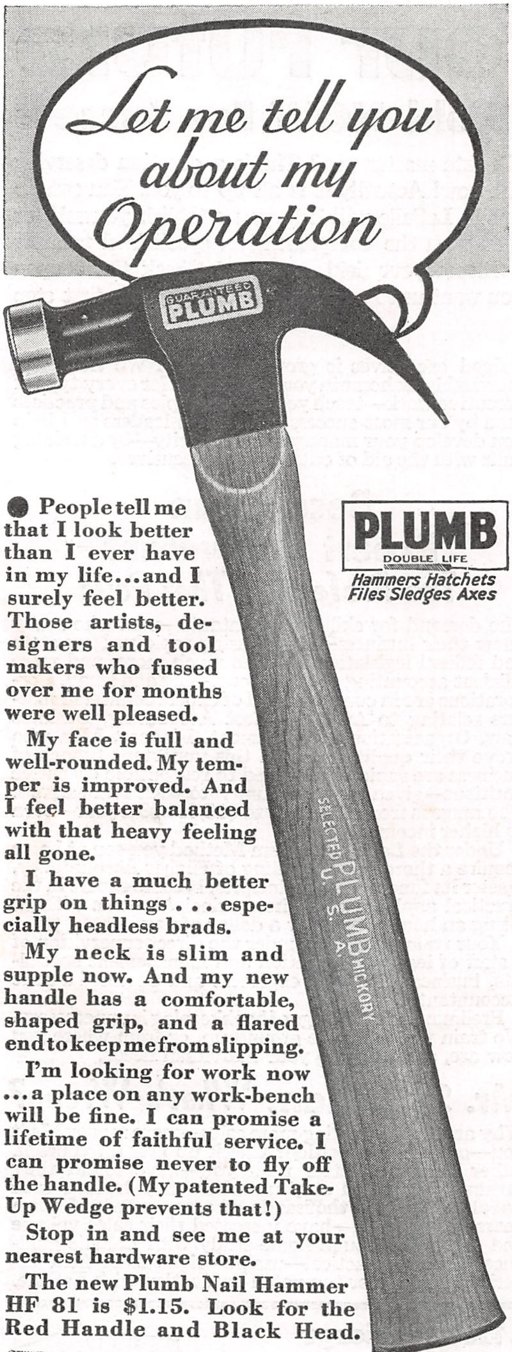
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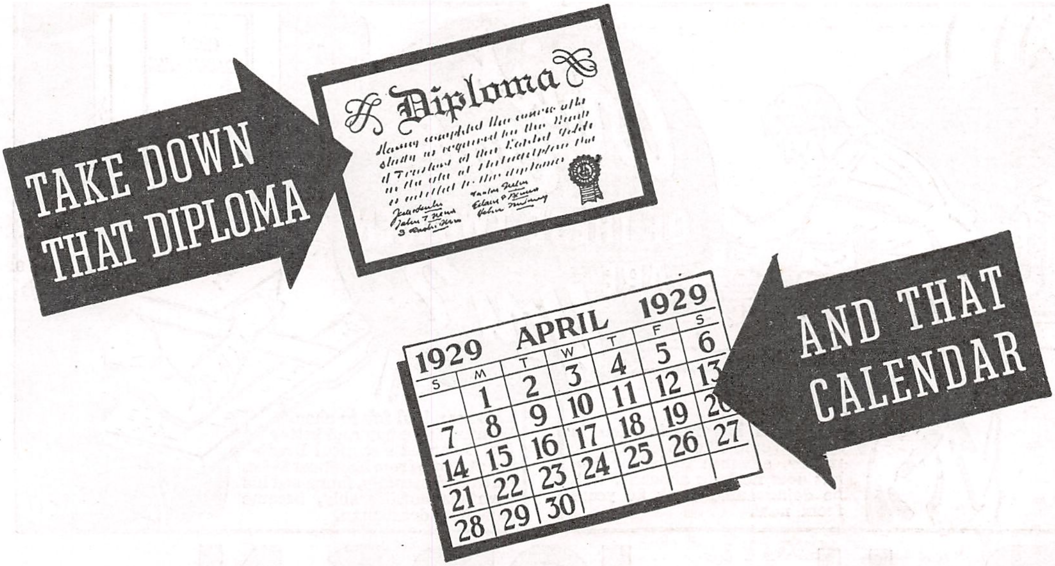

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☐ Foods and Cookery

Name..*Age*....................*Address*..

City..*State*....................*Present Position*..

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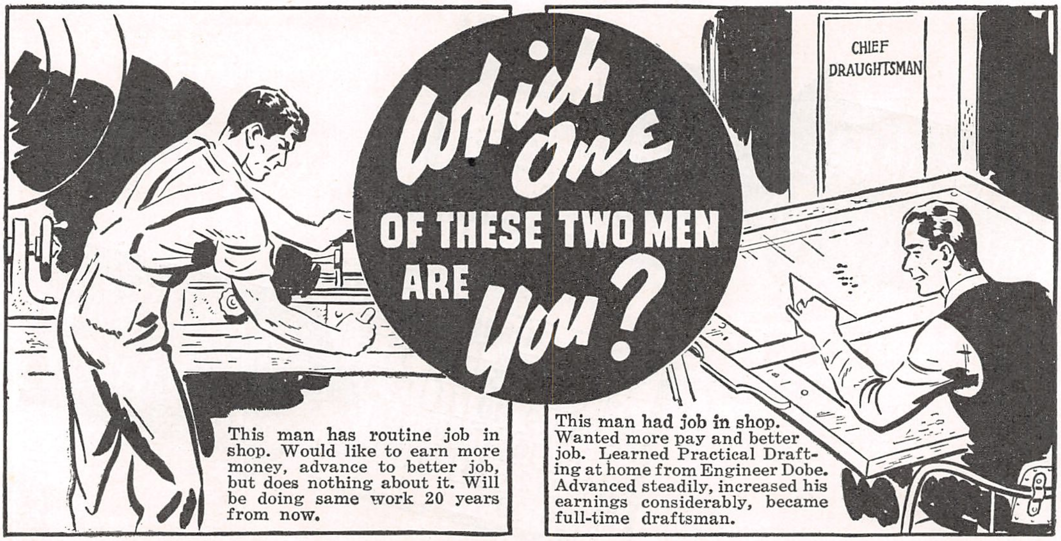

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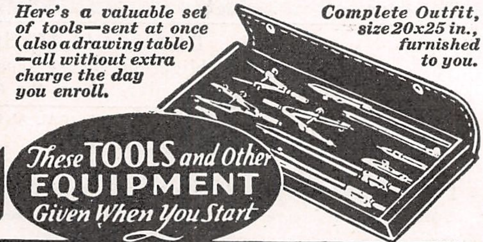

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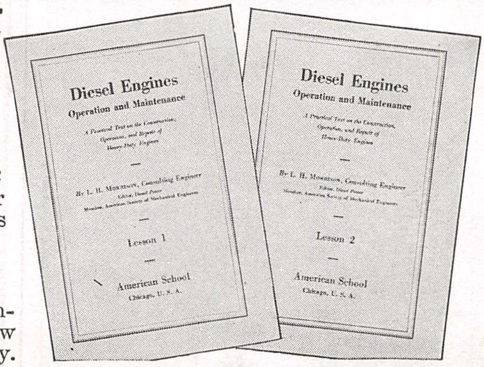
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Now is your chance to get into a big new industry and grow up with it to an important position. Today there is practically no competition in the Diesel field, but the increasing use of Diesel engines will result in keen competition for jobs in the near future. By starting your training now, you can keep ahead of such competition.

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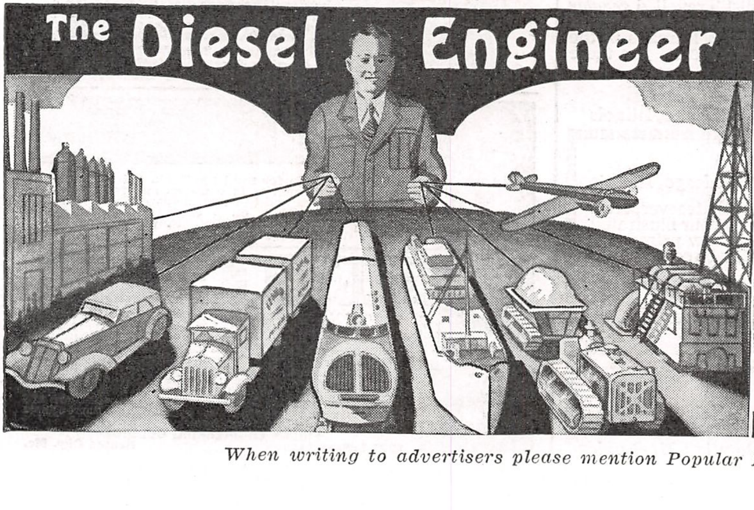

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Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much as $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as $30, $50, $75 a week. Many Radio Experts operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay and see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I have trained are holding good jobs in these branches of Radio. Read their statements. Mail the coupon.

There's a Real Future in Radio for Well Trained Men

Radio already gives jobs to more than 300,000 people. In 1935 over $300,000,000 worth of sets, tubes and parts were sold—an increase of 20% over 1934! Over 1,100,000 auto Radios were sold in 1935, 25% more than in 1934! 22,000,000 homes are today equipped with Radios, and every year millions of these sets go out of date and are replaced with newer models. Millions more need servicing, new tubes, repairs, etc. Broadcasting stations pay their employees (exclusive of artists) more than $23,000,000 a year! And Radio is a new industry, still growing fast! A few hundred $30, $50, $75-a-week jobs have grown to many thousands in less than 20 years.

Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

Practically every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs that you can cash in on quickly. Throughout your training, I send you plans that made good spare time money—$200 to $500 a year—for hundreds of fellows. My training is famous as "the Course that pays for itself."

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National Radio Institute, Washington, D. C.

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NAME...AGE..........

ADDRESS..

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PLAY SAFE

FIND YOUR CAR ON THIS CHART

IMPORTANT! The price per gallon of an anti-freeze means nothing unless you know *how many gallons* you will need during the *entire* winter. You can't get that information on a boil-away anti-freeze. But you *can* get it for "Eveready Prestone" anti-freeze . . . and here it is. See how reasonably you can get two-way protection *all winter long* against both freeze-up and rust with *one shot* of "Eveready Prestone" anti-freeze—one shot because it won't boil off, no matter how warm the weather gets between the cold snaps. If your car isn't on this chart, your dealer has a chart showing all cars; and amounts needed for temperatures to 60° below zero.

Find your car and read from left to right. The first figure shows the protection you get with one gallon of "Eveready Prestone" anti-freeze in the cooling system; the second with one and a half gallons—and so on. "+" means above zero. "—" means below zero. If your car has a hot water heater, add ¼ gallon to the quantity called for.

MODEL	1 GAL.	1½ GAL.	2 GAL.	2½ GAL.
Auburn				
6-52, '34; 6-53, '35; 6-54, '36	+12	− 4	−27	−59
8-100, '32; 8-101, 8-105, '33	+15	+ 2	−16	−42
850, '34; 851, '35; 852, '36	+17	+ 6	− 9	−28
Buick				
40, '34, '35, '36	+ 6	−18	−54	
60, '32; 50, '33, '34, '35	+10	− 8	−34	−62
60, 80, 90, '36	+12	− 4	−27	−59
80, 90, '32; 60, '33, '34, '35	+15	+ 2	−16	−42
80, 90, '33; 90, '34, '35	+19	+ 9	− 3	−19
Cadillac				
370-D, '34, '35	+14	0	−21	−50
355-D, '34, '35; 80, 85, '36	+16	+ 4	−12	−34
452-D, '34, '35; 90, '36	+19	+ 9	− 3	−19
370-A, '31; 355-B, '32; 355-C, '33	+21	+13	+ 3	− 9
60, 70, 75, '36	+22	+15	+ 8	0
Chevrolet				
Stand.; '33, '34, '35	−12	−62		
Master; '33, '34, '35	− 6	−47		
'31, '32	0	−34	−62	
All Models—'36	+ 8	−12	−43	
Chrysler				
6-'32, '33, '34, '35	+12	− 4	−27	−59
8-'31, '32; AF, Imp. '35; 6-'36	+15	+ 2	−16	−42
Roy. 8, Imp. 8, '33; Air 8, '35	+16	+ 4	−12	−34
70, '31; DeLuxe 8, '36	+18	+ 8	− 6	−23
De Soto				
6, '31, '32, '33; 8, '31	+10	− 8	−34	−62
6, '34; Airflow 6, Airstream 6, '36	+16	+ 4	−12	−34
Airflow, Airstream, '35	+12	− 4	−27	−59
Dodge				
6, '32, '33, '34, D2, '36	+ 8	−12	−43	
Senior 6, '30; DU, '35	+12	− 4	−27	−59
8-'32, '33	+15	+ 2	−16	−42
Ford				
A, '30, '31; B, '32, '33	0	−34	−62	
V-8, '32, '33, '34, '36	+18	+ 8	− 6	−23
V-8, '35	+16	+ 4	−12	−34
Graham				
80, 90, 110, '36	+10	− 8	−34	−62
73-Spl. 6; 72-8, '35	+14	0	−21	−50
74-6, '35; 80, '36	0	−34	−62	
6, 8, '33; 6, 8, '34; 75, '35	+16	+ 4	−12	−34
Hudson				
6, '36	+ 3	−25	−62	
8, '31, '32, '33; 6, '35	+12	− 4	−27	−59
8, '35, '36	+17	+ 6	− 9	−28
8, '34	+19	+ 9	− 3	−19
Hupmobile				
18, '31; Cent. 8, '32; 321, '33	+10	− 8	−34	−62
417, 421, '34; 521, '35	+10	− 8	−34	−62
322, '33; 422, '34; 518, '35;	+17	+ 6	− 9	−28
6-618-G '36	+17	+ 6	− 9	−28
326, '33; 426, '34; 527, '35;	+19	+10	0	−15
8-621-N '36	+19	+10	0	−15
Lafayette				
'34; '35; '36	+15	+ 2	−16	−42
La Salle				
50 (Str. 8) '36	+10	− 8	−34	−62
350, '34; 35-50, '35	+15	+ 2	−16	−42
345-B, '32; 345-C, '33	+21	+13	+ 3	− 9
Lincoln				
Zephyr, '36	+21	+13	+ 4	− 7
136,'33,'34,'35,'36;145,'34,'35,'36	+23	+17	+10	− 2
Nash				
60, 70, '31; 960, 970, '32	+ 3	−25	−62	
1130, 1070, 1170, '33; 1220, '34	+12	− 4	−27	−59
3620, 3640, 3640A, '36	+14	0	−21	−50
1280, '34; 3580, '35; 1080, 1180, '33	+17	+ 6	− 9	−28
Oldsmobile				
F-30, '30; F-31, '31; F-35, '35;	+ 3	−25	−62	
F-36, '36	+ 3	−25	−62	
F-32, L-32, '32; F-33, '33;	+12	− 4	−27	−59
L-35, '35; L-36, '36	+12	− 4	−27	−59
L-33, '33; L-34, '34	+15	+ 2	−16	−42
Packard				
120-'35, '36	+14	0	−21	−50
Sup. 8, '33; '34; 8, '33, '34, '35	+16	+ 4	−12	−34
Sup. 8, '35	+18	+ 8	− 6	−23
745, '30; 845, '31; DeLuxe, '32	+21	+13	+ 3	− 9
12, '33, '34, '35, '36	+25	+21	+10	+ 3
Pierce Arrow				
41, 42, 43, '31; 54, '32; 836-A, '34	+21	+13	+ 3	− 9
1601-8, '36	+21	+13	+ 3	− 9
840-A, '34; 845, '35	+22	+15	+ 6	− 5
1602-03 (12), '36	+24	+20	+15	+ 9
Plymouth				
'30; PF. PG. '34	+ 6	−18	−54	
PA, '31; PB, '32; PE, '34; PJ, '35;	+10	− 8	−34	−62
P1, P2, '36	+10	− 8	−34	−62
PC, PD, '33	+ 3	−25	−62	
Pontiac				
'30; '31; 6-'32; '35	+ 6	−18	−54	
8-'33, '34, '35; 6-'36	+ 8	−12	−43	
8-'36	+12	− 4	−27	−59
Reo				
6-21, 6-25, '32; FC '35; Roy. '35;	+15	+ 2	−16	−42
6D, '36	+15	+ 2	−16	−42
8-25, '32; S-2, '33; S-6, '34	+16	+ 4	−12	−34
Studebaker				
Dict. 6, '36	+ 6	−18	−54	
Comm. 8, '31, '32, '33;	+10	− 8	−34	−62
Dict. 6, '34, '35	+10	− 8	−34	−62
Dict. '31, Comm. 8, '34,	+14	0	−21	−50
Pres. 8, '33, '34, '36	+14	0	−21	−50
Pres. 8, '31, '32, '35; Comm. 8, '35	+17	+ 6	− 9	−28
Terraplane				
6, '32, '33; 6 Spec. '35; 6, '36	+ 3	−25	−62	
8, '33; 6 DeLuxe, '35	+10	− 8	−34	−62
6, '34	+14	0	−21	−50

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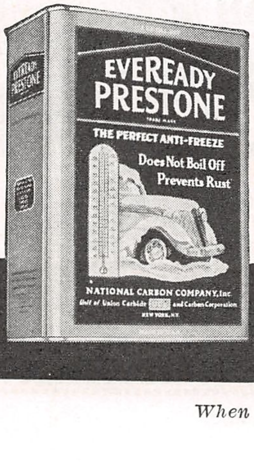

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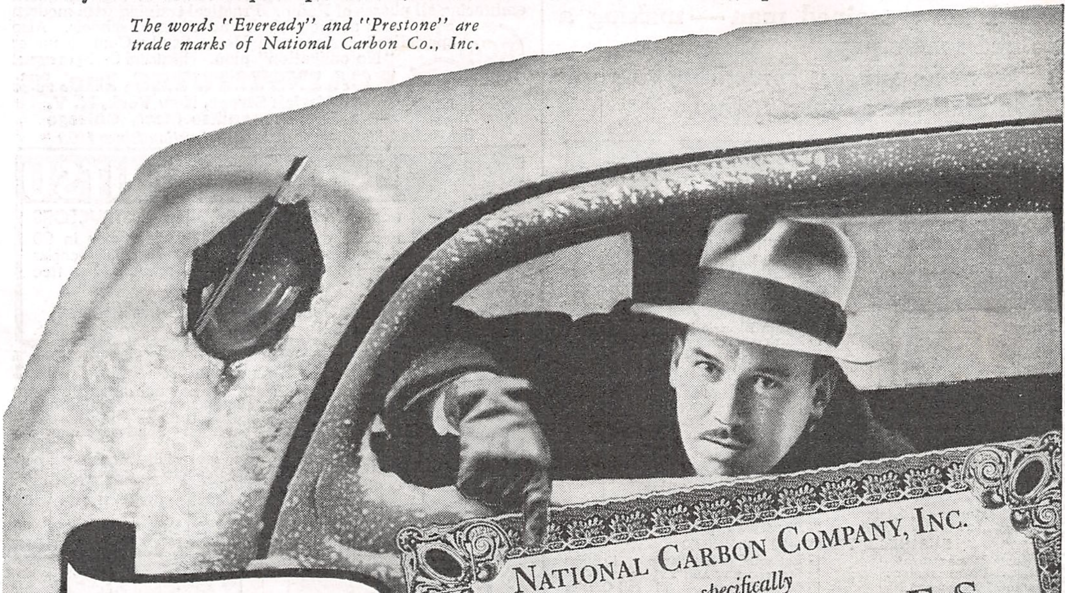
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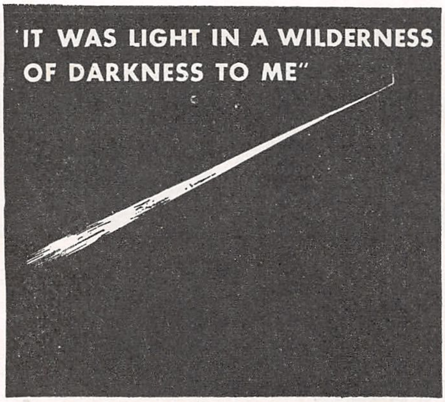
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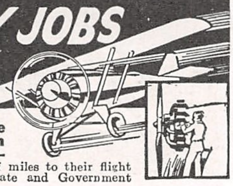

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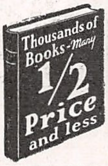
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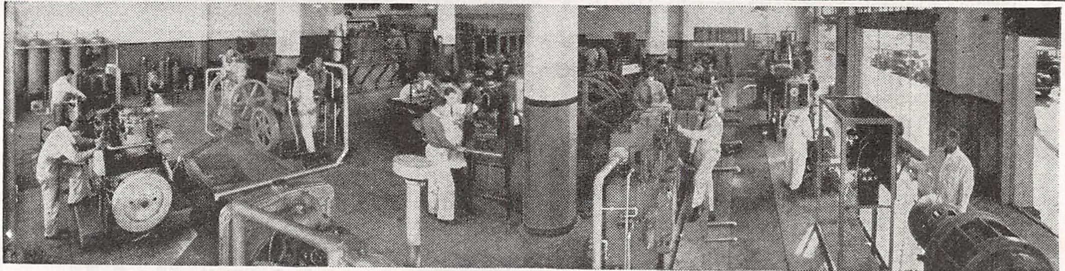

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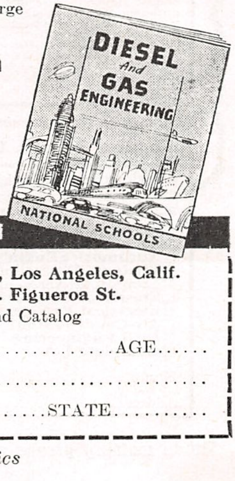

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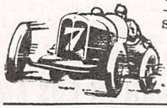

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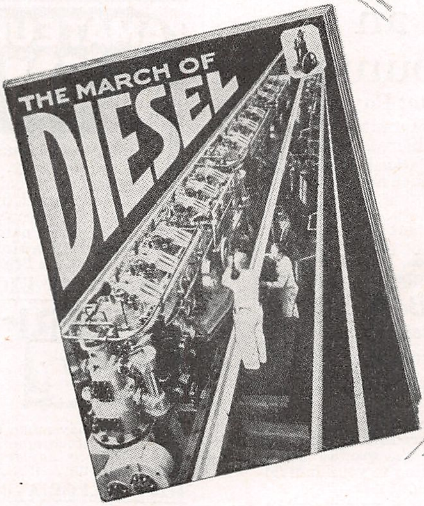

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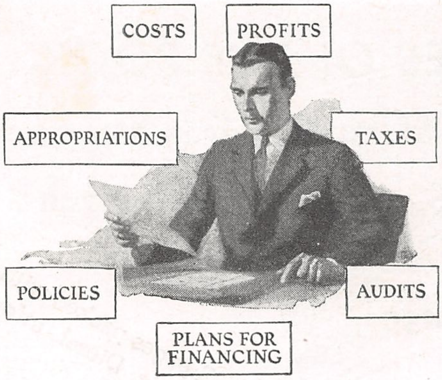

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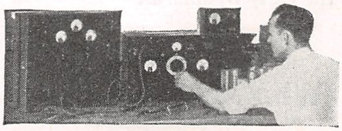

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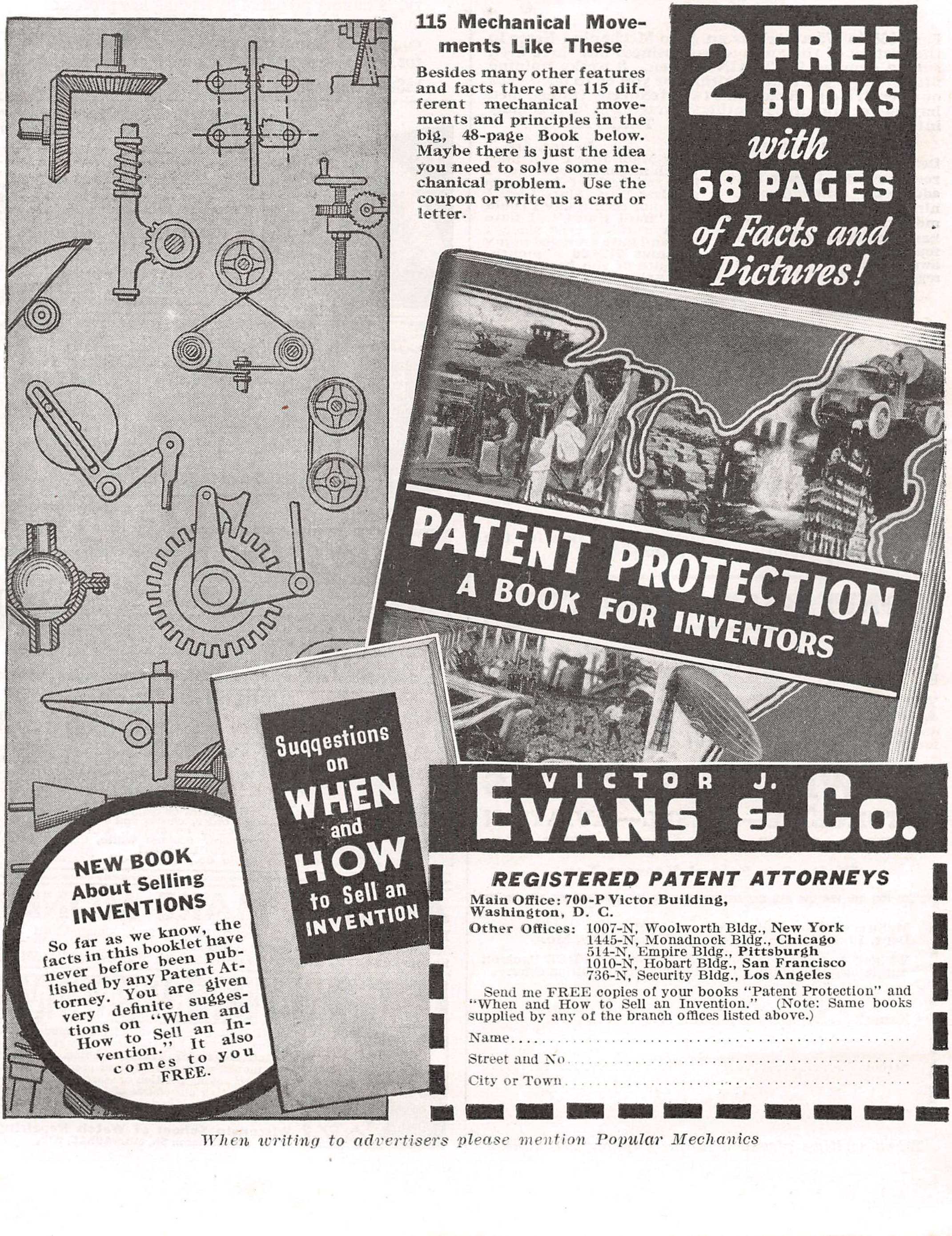

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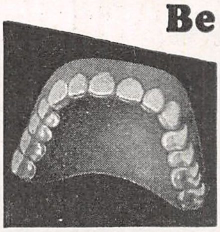

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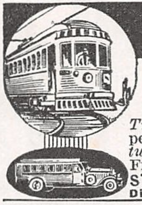

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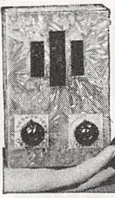

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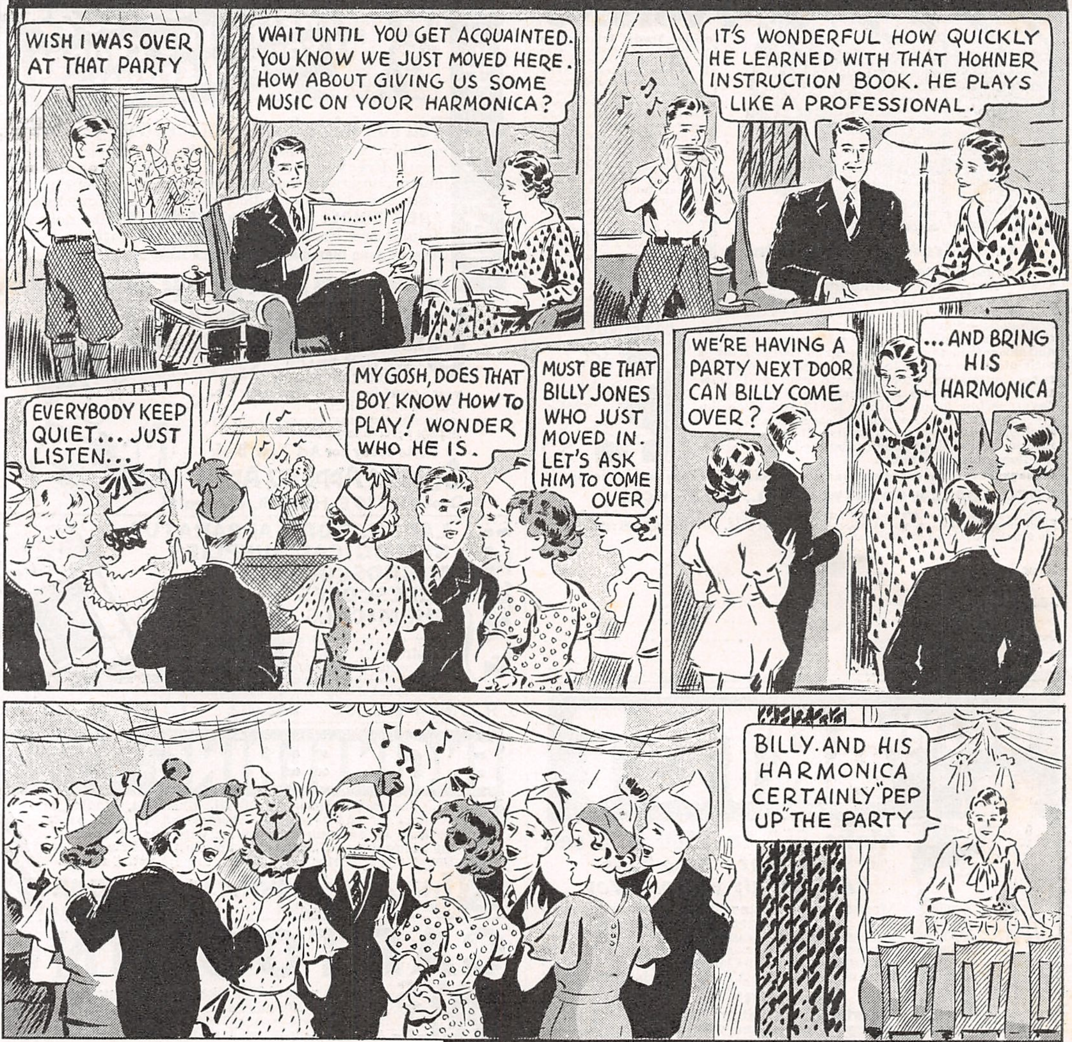
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...AND BRING HIS HARMONICA
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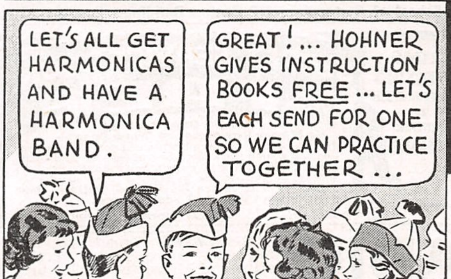
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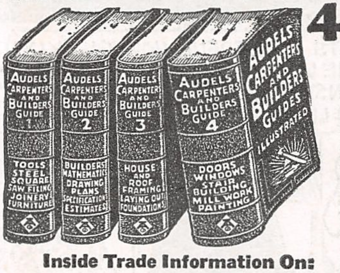
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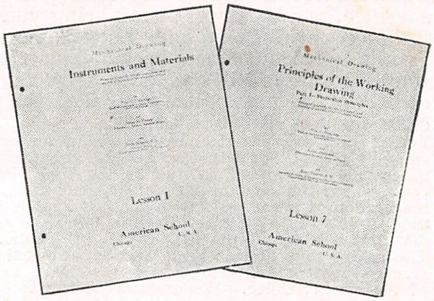

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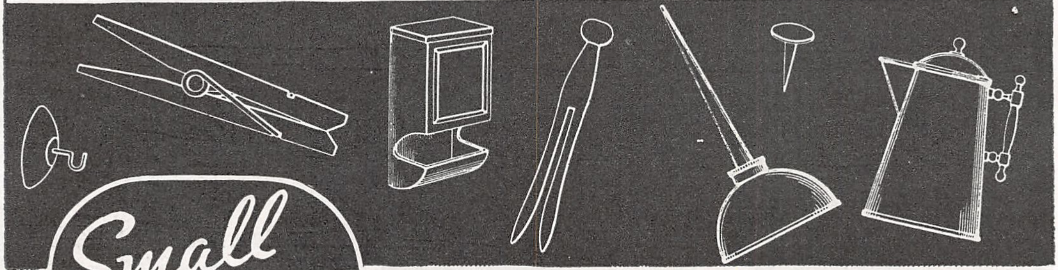

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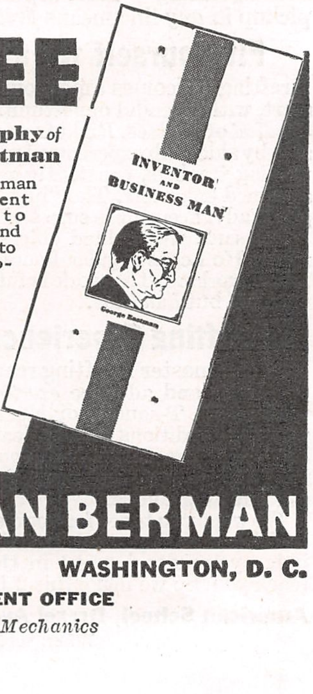

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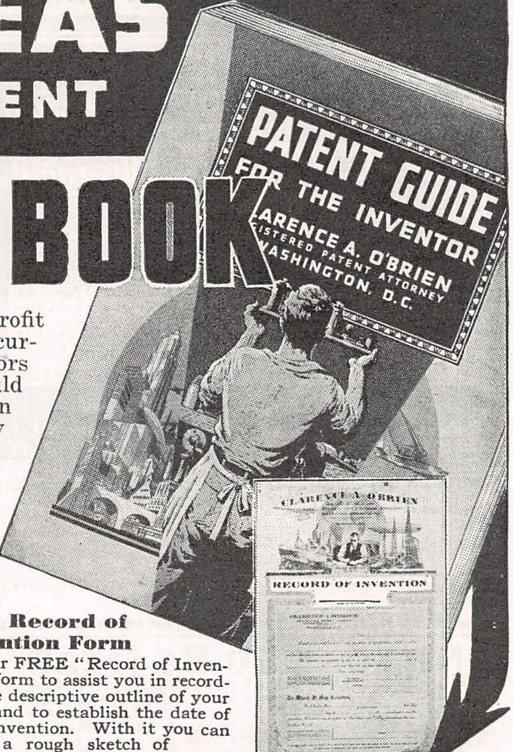

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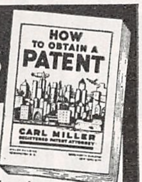
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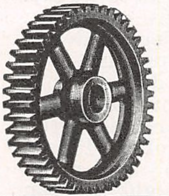

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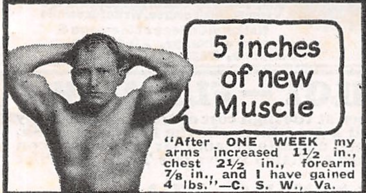
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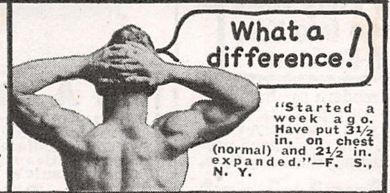
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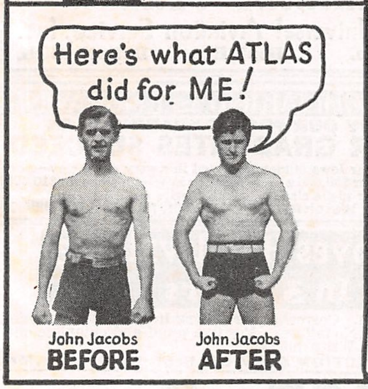
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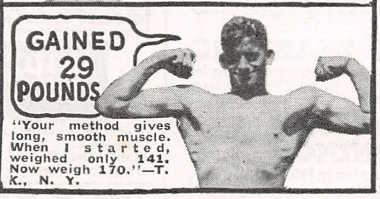
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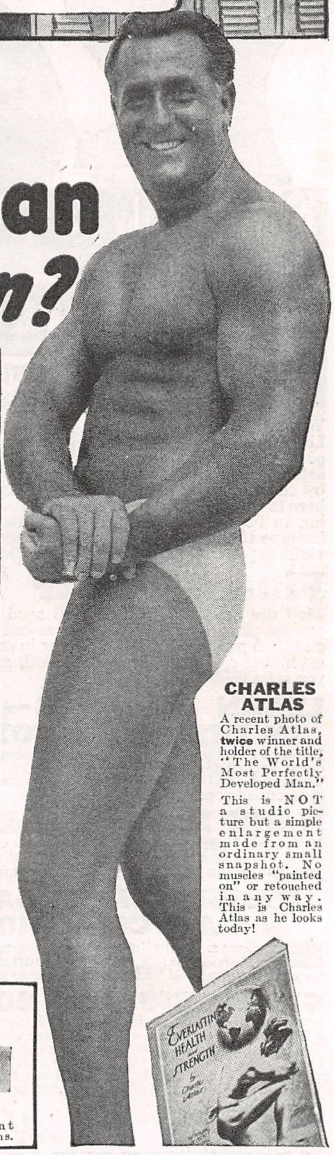
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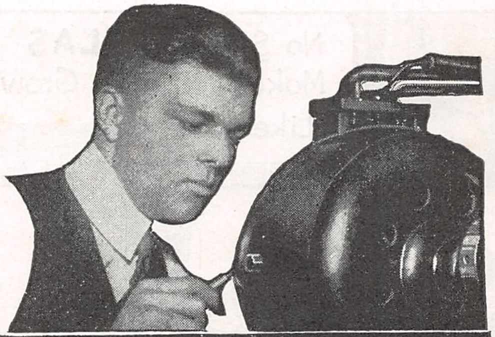

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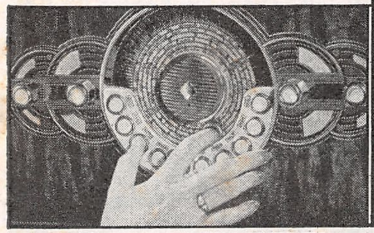

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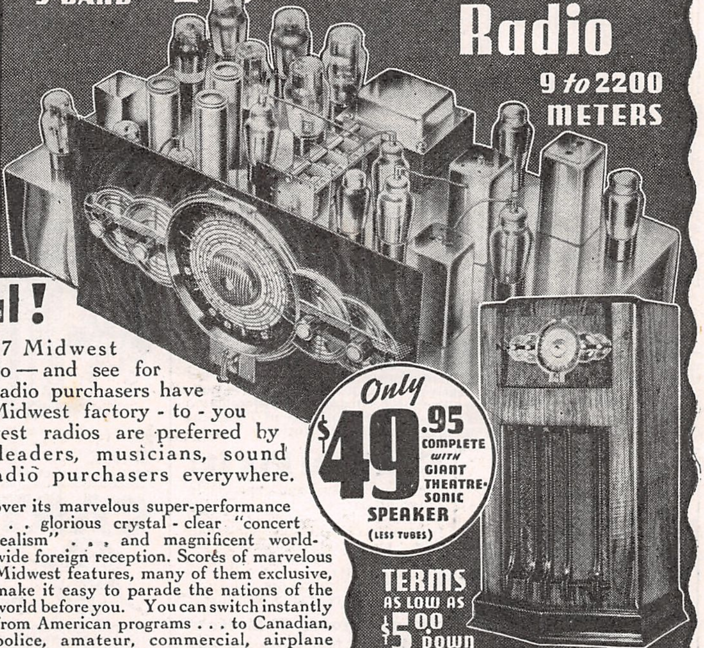

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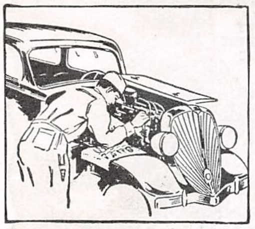

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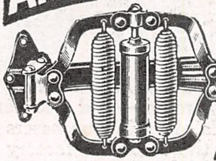

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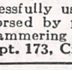

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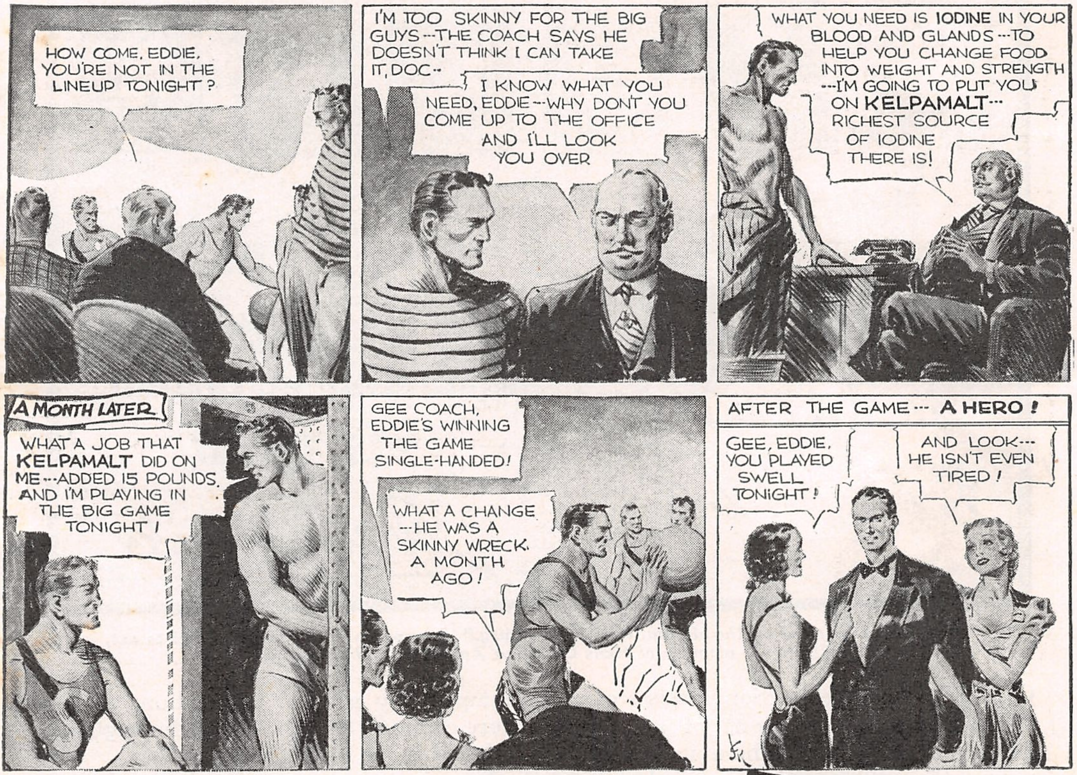
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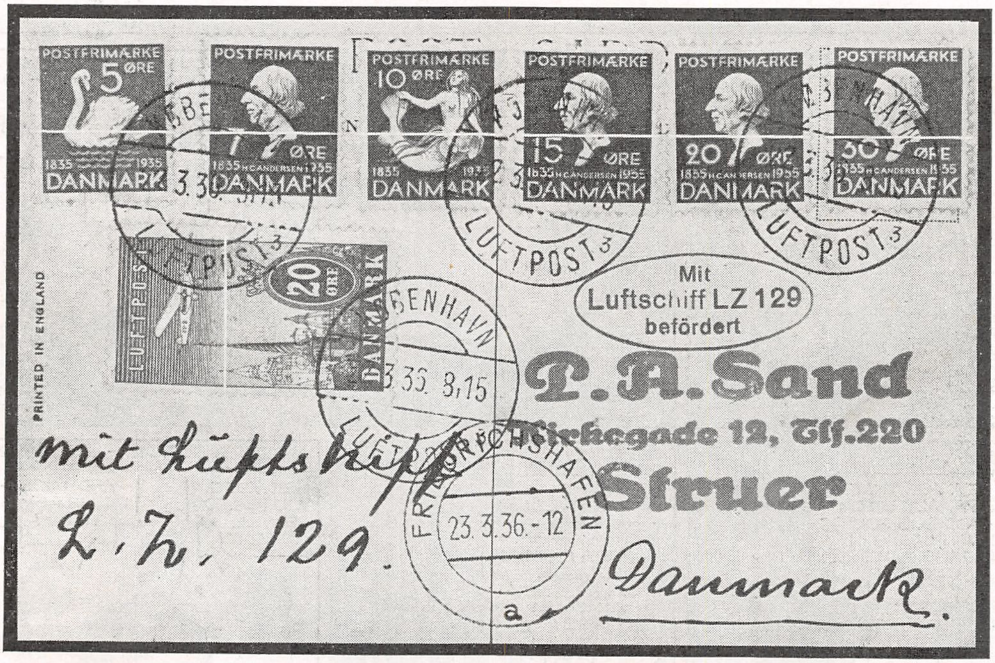
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(Continued to page 50A)

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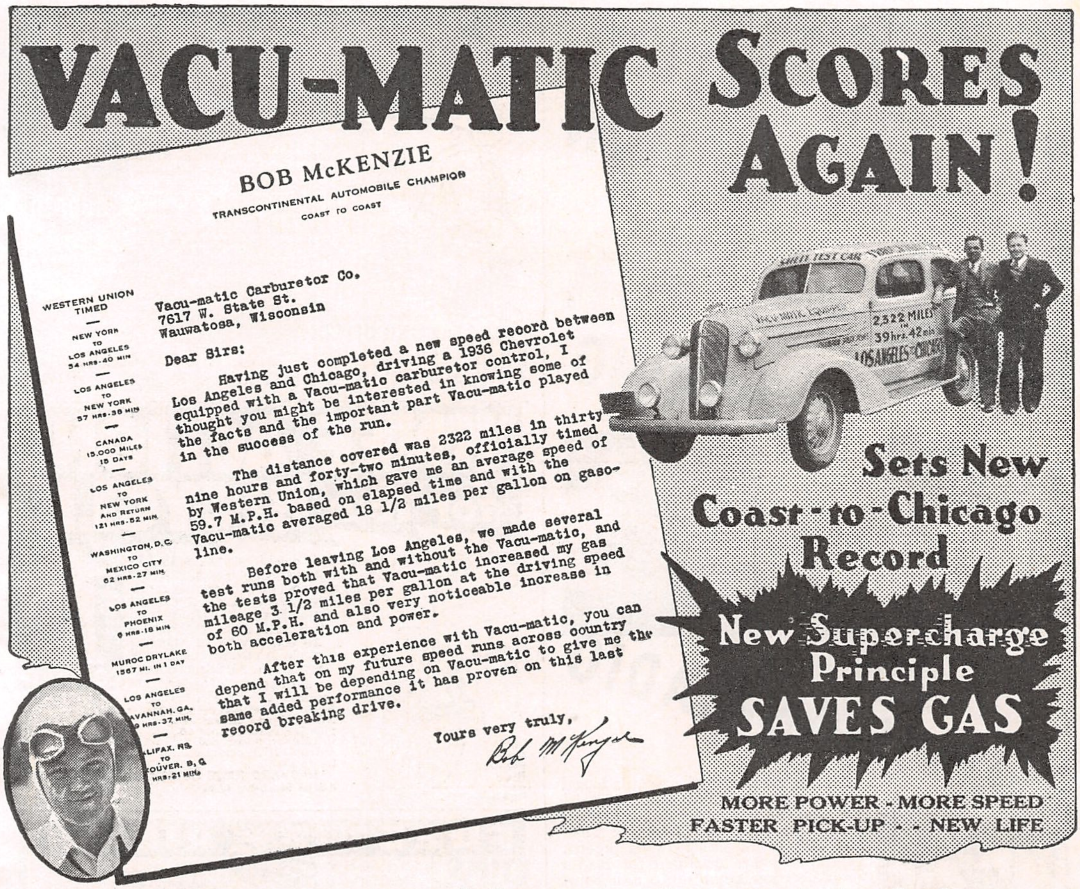

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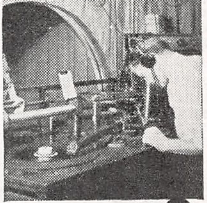

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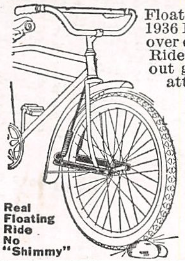

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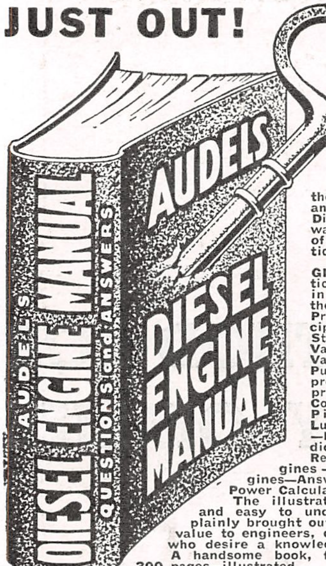

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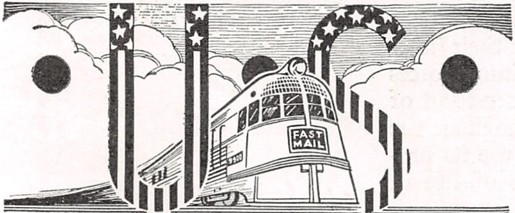

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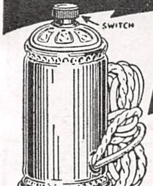

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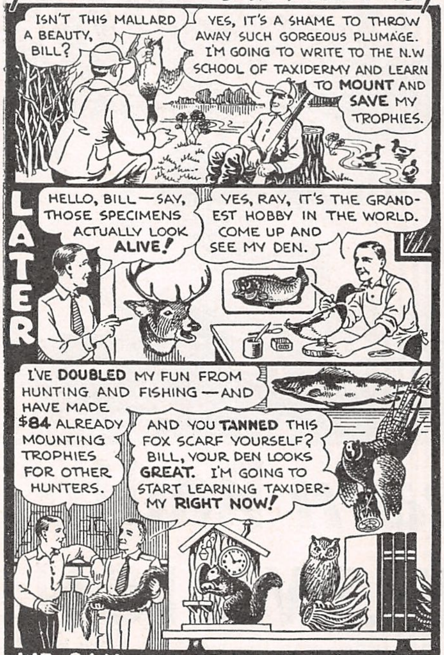
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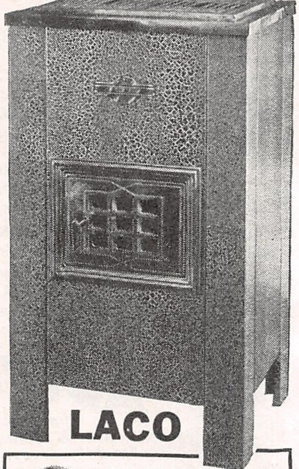

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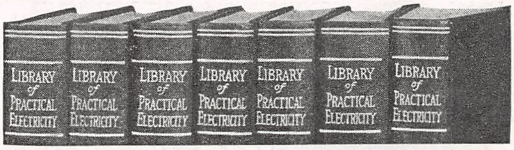
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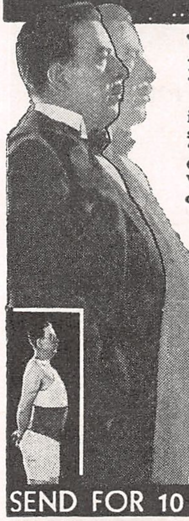

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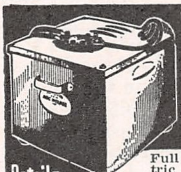

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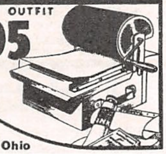

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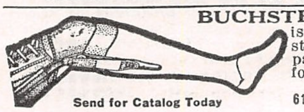

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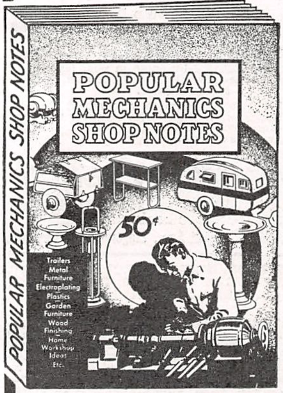

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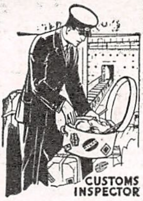

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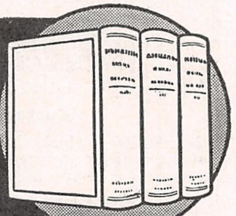

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State of Illinois, County of Cook, ss.

Before me, a notary public in and for the state and county aforesaid, personally appeared H. H. Windsor, Jr., who, having been duly sworn according to law, deposes and says that he is the editor of the Popular Mechanics Magazine and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit: First. That the names and addresses of the publisher, editor, managing editor, and business manager are: Publisher, Popular Mechanics Co., 200 East Ontario St., Chicago, Ill. Editor, H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Managing Editor, L. K. Weber, 200 East Ontario St., Chicago, Ill. Business Manager, Willis S. Brown, 200 East Ontario St., Chicago, Ill. Second. That the owner is: (If owned by a corporation, its name and address must be stated, and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Popular Mechanics Company, 200 East Ontario St., Chicago, Ill. L. B. Windsor, 200 East Ontario St., Chicago, Ill.; H. H. Windsor, Jr., 200 East Ontario St., Chicago, Ill. Third. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. Fourth. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. H. H. Windsor Jr., Editor. Sworn to and subscribed before me this 23rd day of September, 1936. J. GRAHAM, Notary Public. (My commission expires June 16, 1940.)

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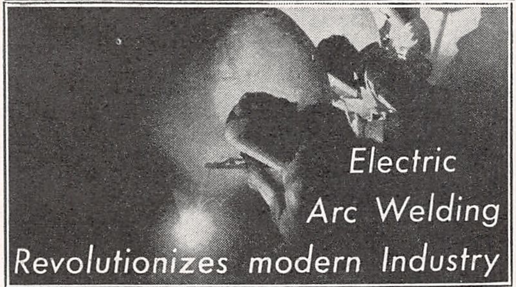

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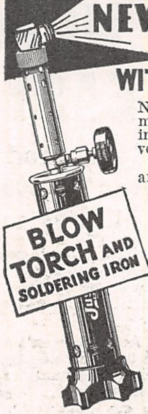
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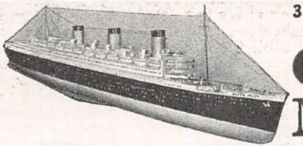

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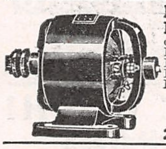

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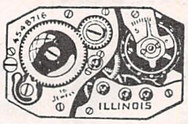

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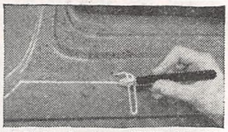

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Your thirty-day trial with complete business equipment is absolutely guaranteed against money-risk. Business easily handled. No large stock to carry, no overhead expenses. Make your home headquarters. Use the 'phone, make personal calls. Once started, I give you credit — let you operate on my money.

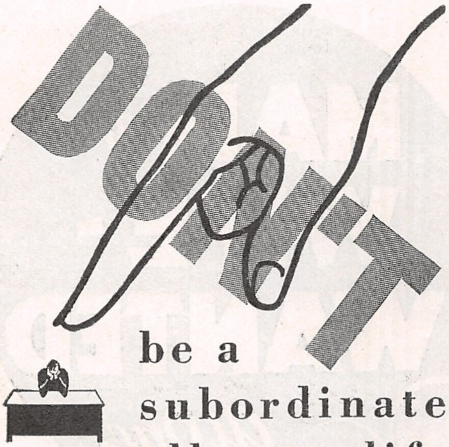
This offer is made in good faith by a large and reputable company noted for the quality of products *absolutely guaranteed*. Send for full facts. Details are free. Send coupon—ACT AT ONCE.

ALBERT MILLS, Pres.
4708 Monmouth Ave. Cincinnati, Ohio

ALBERT MILLS, Pres.
4708 Monmouth Avenue, Cincinnati, Ohio

Without obligation to me please send full facts about how you enable me to establish a local Coffee Agency paying up to $60 in a week, without money-risk to me.

Name..
Address...
....
(Please print or write plainly.)



be a subordinate all your life

● YOU LIVE ONLY ONCE—make the most of that life! Be happy in your personal life—be successful in your business life. Don't be content merely to curse the fates that keep you in a subordinate's place. Kick these fates out of your life. The first healthy step toward doing it is to mail this coupon to the International Correspondence Schools. This institution can give you the training it takes to get ahead these days.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 5646-H, Scranton, Penna.

Without obligation, please send full particulars about the subject before which I have marked X:

TECHNICAL AND INDUSTRIAL COURSES

☐ Architect
☐ Architectural Draftsman
☐ Building Estimating
☐ Contractor and Builder
☐ Structural Draftsman
☐ Structural Engineer
☐ Electrical Engineer
☐ Electric Lighting
☐ Welding, Electric and Gas
☐ Reading Shop Blueprints
☐ Telegraph Engineer
☐ Telephone Work ☐ Radio
☐ Mechanical Engineer
☐ Mechanical Draftsman
☐ Machinist ☐ Toolmaker
☐ Patternmaker
☐ Foundry Practice
☐ Sheet Metal Worker
☐ Boilermaker
☐ Heat Treatment of Metals
☐ Management of Inventions
☐ Diesel Engines
☐ Aviation Eng. ☐ Auto Mechanic
☐ Plumbing ☐ Heating
☐ Air Conditioning ☐ Refrigeration
☐ Steam Engineer
☐ Steam Electric Engineer
☐ Marine Engineer
☐ Civil Engineer ☐ Highway Engineer
☐ Bridge Engineer
☐ Bridge and Building Foreman
☐ Surveying and Mapping
☐ R. R. Locomotives ☐ Air Brakes
☐ R. R. Section Foreman
☐ R. R. Signalmen
☐ Chemistry ☐ Pharmacy
☐ Coal Mining
☐ Navigation
☐ Cotton Manufacturing
☐ Woolen Manufacturing
☐ Agriculture ☐ Fruit Growing
☐ Poultry Farming

BUSINESS TRAINING COURSES

☐ Business Management
☐ Industrial Management
☐ Traffic Management
☐ C.P.Accountancy
☐ Bookkeeping
☐ Secretarial Work
☐ Cost Accountant
☐ Salesmanship ☐ Advertising
☐ Service Station Salesmanship
☐ Business Correspondence
☐ Lettering Show Cards ☐ Signs
☐ Stenography and Typing
☐ Civil Service ☐ Mail Carrier
☐ Railway Mail Clerk
☐ Grade School Subjects
☐ High School Subjects
☐ College Preparatory
☐ First Year College Subjects
☐ Illustrating ☐ Spanish
☐ Cartooning ☐ French

DOMESTIC SCIENCE COURSES

☐ Professional Dressmaking and Designing
☐ Home Dressmaking
☐ Advanced Dressmaking
☐ Millinery
☐ Foods and Cookery
☐ Tea Room and Cafeteria Management, Catering

Name...*Age*..................
Address..
City...*State*..................
Present Position..

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada

STAMPS and COLLECTING

(Continued from page 36A)

At one time loose-leaf printed albums were published with spaces for the world's stamps. These had high-grade binders or covers and heavy durable pages. Today they are largely superseded by specialty albums which are similar in construction and finish, but which provide spaces for the stamps of one country, or a definite group of countries or colonies. These have proved much in demand and have been laid out to follow the lines of collecting which one is apt to follow. Other sectional, printed loose-leaf albums, which use standard ring binders, are available for the stamps of individual countries and for the topical selections so much in vogue today.

Loose-leaf, blank page, albums offer the only solution for a specialized collection for here the collector has complete freedom in mounting stamps, covers and information. Binders for these albums cover a wide range of prices as do the pages which may be had completely blank or with a fine quadrille ruling to aid in mounting. The most desirable type of these albums utilizes a post binder and obtains flexibility through a linen-hinged page.

Beginners should use a moderate-priced album until they have learned how to mount stamps neatly and keep the pages clean. Never start with a set of albums of high quality for they are almost certain to be ruined within a few years.

United States Stamps of 1936

The United States Post Office department opened the year by issuing a three-cent, violet stamp on March 2, at Gonzales, Tex., to commemorate the 100th anniversary of Texan freedom. This stamp was of the large size usually associated with our commemoratives. Next came the souvenir block of four all different three-cent, violet stamps issued to compliment the Third International Philatelic Exhibition held in New York. This imperforate block, familiarly called the "Tipex" sheet, contains reproductions of the Connecticut, California-Pacific, Michigan and Texas commemorative stamps, and is surrounded by a frame of lettering explaining the

(Continued to page 70A)

FOR *Real* FUN *Play* A *Soprani*

ACCORDION

Easy
TO PLAY

● If you want to be *really* popular, have *all* the fun, the center of attraction *everywhere*, just learn to play this thrilling instrument from Italy. A complete band or orchestra in itself, and so easy to learn to play. You'll master this *easier* Soprani in *no time*, and you'll have real fun from the start. Don't delay. Big future. Send postal for beautifully illustrated literature. No obligation. Easy terms. Write today sure. ● 122

SOPRANI, INC. DEPT. 1229, 630 S. WABASH AVE.
CHICAGO, ILL.

PHOTO-ENGRAVING LEARN IT AT HOME

A copper plate to print above picture size 8 by 10 inches sells for $15.37

We Furnish all equipment and materials including large photo-engraving camera complete with lamps, lens and screen. When you have finished the course you can establish a good paying independent business with the equipment furnished or work for others at a big salary. Photo-Engraving offers greater opportunities today than any other industry. Every picture in this issue of Popular Mechanics was engraved by the process we teach you. Earn good money while learning. Write today for our new illustrated catalog which was engraved on equipment such as we furnish. You will not be obligated in any way by writing **Aurora School of Photo-Engraving, Dept. 1126, Aurora, Mo.**

MEN-WOMEN

EVERYBODY WANTS *FREE* GIFTS

A large 25 year old company has a unique plan of distributing free gifts. Right now they are giving away, under their plan, to you and your friends WITHOUT COST a beautiful gift of universal appeal. Really an ornamental necessity that will be cherished in any home. If you wish you can also make amazing big money telling others about this plan. Nothing to buy or sell. Get facts quick.

GARDEN CITY NOVELTY CO.
4318-E Ravenswood Ave., Chicago, Ill.

WANTED MEN

OPERATE POTATO CHIP STORES

We furnish everything—help finance and locate you. No experience needed. Tremendous profits. Sensational introductory starting plan. No house-to-house canvassing. Wonderful opportunity. Rush name for free book of Profit Facts—today!

LONG-EAKINS COMPANY
1228-S High Street, Springfield, Ohio

BULL DOG *Trailer* HITCH

CHEAPEST TRAILER INSURANCE in the world. DROP FORGED **Bull Dog Hitch** NEVER LETS LOOSE! GUARANTEED AGAINST BREAKAGE. Certified tensile strength up to 52,400 lbs. Unfastens easily at any angle BUT ONLY when desired. Wear compensator prevents back lash, lost motion, noise. A type for every trailer. Used EXCLUSIVELY by Biggest Trailer Manufacturers. WRITE TODAY for FREE details. (Include only 50c for latest Guaranteed Trailer Builder's Guide.)

HAMMER BLOW TOOL CO. Dept. BD-12 WAUSAU, WIS., U. S. A.

Hand Out FREE CIGARETTES

EARN UP TO $95 WEEKLY

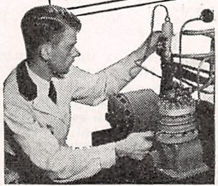
introducing NEW WAY TO SMOKE. We furnish you Free Cigarettes. Ask any man to have a Free Smoke. Hand him LIGHTED Cigarette from beautiful pocket-size "Magic Case." Just touch button. Presto! Out comes *Lighted* Cigarette automatically. No batteries or electricity. Get Magic Case for 15 days' trial at our risk. State favorite brand cigarettes.

MAGIC CASE MFRS., Dept. W-371
4234 Cozens Ave. St. Louis, Mo.

FREE BOOK

TELLS HOW TO EARN UP TO $30-$50 *and more* WEEKLY!

ELECTRIC REFRIGERATION AIR CONDITIONING
AN INDUSTRIAL GIANT THAT COMMANDS WORLD-WIDE ATTENTION AND OFFERS UNUSUAL OPPORTUNITIES TO MEN WHO ARE PROPERLY QUALIFIED AND TRAINED
UTILITIES ENGINEERING INSTITUTE
CHICAGO NEW YORK



ELECTRIC REFRIGERATION AIR CONDITIONING

Think of it, Man! Here are two new rapidly growing industries that offer the very opportunity you are looking for. Big Pay, Fascinating Work and an extremely bright Future. Here's what one of America's best-known engineers says about YOUR opportunity. He states, "The greatest demand today is for specially trained men and the big question facing the industry is how these men are to be found." Here's a condition that spells O-P-P-O-R-T-U-N-I-T-Y for you—in great big capital letters.

Where would you be today if you had been able to cash in on one of the opportunities offered by the Radio and Automobile Industries when they were new? Think how men's salaries soared—how "beginners" were skyrocketed into permanent prosperity. RIGHT NOW the opportunities offered in Refrigeration and Air Conditioning are just as big as they ever were in the Radio or Auto fields. And they're getting BIGGER every day.

MEN NEEDED NOW

RIGHT NOW there are new jobs for thousands in Electric Refrigeration and Air Conditioning. Prepare for your opportunity at home in spare time by U. E. I.'s low-cost, easy-pay plan. Learn EVERYTHING—Engineering, Estimating, Installation and Servicing under a highly successful system that has brought outstanding results during the past TEN YEARS. Then get practical experience in one of our large, completely equipped Laboratories where you'll **learn by doing.**

LET US HELP YOU PREPARE FOR A BIG PAY JOB

Decide now to prepare for a big-pay, full time or spare time position in Electric Refrigeration and Air Conditioning—as we have helped hundreds of others. U. E. I. trained men are now employed by leading manufacturers, distributors and service organizations throughout the United States, Canada and elsewhere. U. E. I. Employment Service is offered you FREE of extra cost. What it has done for others it can do for you. Mail the Coupon for Book of Facts about your opportunity.

HERE'S PROOF U.E.I. TRAINING HELPS MEN GET JOBS

"Got job with Mr. H., one of the men to whom you wrote letters . . . signing up to take your course was one of the wisest things I ever did." L. E. C., Calif.

"Called on Mr. W. of the Ideal Refrigeration Company and fact I had training with U. E. I. got me job. Mr. W. is a U. E. I. graduate." W. F. L., Mich.

"Secured employment with C. & S., one of firms to which you referred me . . . taking full charge of Service Departments." R.R.W., Ill.

"Am now employed by Frigidaire in charge of assembly of self-contained room coolers . . . would never have made it without your training." J.S.S., Ohio.

"Commenced your course in March. It is now November and through your recommendation I obtained position with S. & M. of this city . . . and have already been promoted to field work." F.C.M., Neb.

"I had no trouble locating job paying better than expected, thanks to U. E. I. training and opportunity you extended." O.I.B., Okla.

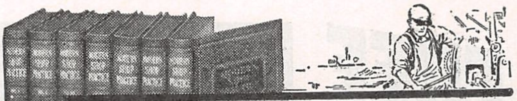
The Same Opportunity May be Yours

MAIL COUPON TODAY

UTILITIES ENGINEERING INSTITUTE
Established 1927
400-410 N. Wells St.
Dept. 1126, Chicago, Ill.

Utilities Engineering Institute, Dept. 1126,
400-410 N. Wells St., Chicago, Ill.
Please send me your Free Book telling about MY opportunity in Air Conditioning and Electric Refrigeration. I have marked the one that interests me most.
☐ Air Conditioning. ☐ Electric Refrigeration.

NAME..
ADDRESS...
CITY...................................STATE.......................



MECHANICAL ENGINEERING

Pays Big NOW!

Less than **20 minutes** a day with these 7 big mechanical engineering books entitled "Modern Shop Practice," will prepare you for a **better job** and **bigger pay.** Machine hands become foremen and superintendents, helpers become experts, foremen become managers. Any machinist, helper or factory employee can benefit QUICKLY and can command more money.

Your Opportunity Don't miss this chance to qualify for promotion, don't put off for one minute this Big Opportunity which is yours almost for the asking. Seven Big Books chockful of every known mechanical fact, told so simply and clearly that any one can understand them. Over 2600 pages, nearly 2700 illustrations cover every subject fully, including Tool Making, Pattern Making, Foundry Work, Mechanical Drawing, Forging, in fact anything you need to know.

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Complete set of drawing instruments if you send for these books NOW. These instruments are made of the finest of German silver, are absolutely accurate and are packed in velvet lined leatherette pocket case. Real $10 value but free to you with these books.

American Technical Society, Dept. M919, Drexel at 58th St., Chicago

You may send me the 7 big NEW books for free examination. I will pay the few cents delivery charges only unless I decide to keep them in which case I will send $2.00 in ten days and $3.00 per month until the total price of only $29.80 is paid. If I return them in 10 days I will owe you nothing. Because I send now, you agree to **give me** a membership in the American Technical Society entitling me to Free consultation privileges with any of your experts for one year and set of drawing instruments.

Name..

Address..

Please attach a letter stating age, occupation, employer's name and address and that of at least one business man as reference.

AUTO-MECHANICS & WELDERS

GOOD JOBS and Mighty GOOD PAY

Do you want to earn big money? If so let us know which of the following trades you prefer. You learn by doing. Practical work. Expert teachers. Low tuition. Personal attention. It will pay you to investigate AT ONCE. Just check the courses you'd like to take and mail today. You will receive full information, absolutely without cost or obligation. But don't delay.

Check the Trade You'd Like to Learn

☐ Auto Mechanics
☐ Auto Collision
☐ Metal Finishing
☐ Welding
☐ Spray Painting
☐ Torch Soldering

Name ....

Address ....

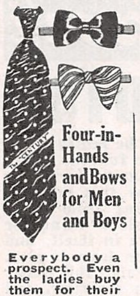
Mail the above to

MICHIGAN TRADE SCHOOL

Write for FREE CIRCULAR

3758 Woodward Avenue DETROIT, MICH.

BIG LEADER—SELLS ON SIGHT



Genuine Leather Ties

LOOK LIKE SILK. Won't wrinkle. Wear indefinitely. Over 50 patterns. We manufacture two lines, "Century High-Grade" and a lower-priced line.

Four-in-Hands and Bows for Men and Boys

Four-in-Hands in Beautiful colors and designs. Cleaned with damp cloth. Big profits. Repeat orders. Young man sold 2 dozen ties one afternoon after school.

Century Bows known from coast to coast for quality, workmanship and satisfaction. Big outlets: lettercarriers, policemen, firemen, gasoline stations, bus, bakery, laundry drivers, etc.

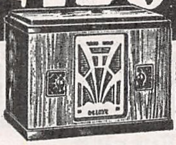
Everybody a prospect. Even the ladies buy them for their sweethearts and husbands.

Send 50c for sample kit, including Bow and 4-in-Hand

Century Tie Co., Mfrs.

Dept. A, 2345 W. Grand Blvd., Detroit, Mich.

Make up to $150 Weekly GIVING AWAY FREE RCA LICENSED RADIOS



We offer this and other money making plans to all salesmen, distributors, cardmen, punch board men and agents with our new full 1937 line consisting of **30 beautiful and exclusive Radio Models** for home, auto, and farm use. Make up to $150 cash in a week for yourself. Every dealer and sub-agent, home, car owner, store, office, factory, lodge, club or individual wants these marvelous new plans for giving away FREE WORLD FAMOUS RCA LICENSED DE LUXE RADIOS. WRITE TODAY FOR OUR NEW STARTING OFFERS. Start at once making money with our unique sales plans. Write for full information how you can secure any or all of these plans FREE.

DELUXE MFG. CO., Dept. 287, 173 W. Madison St., Chicago, Ill.

CANS, JARS and BOTTLES Fly Open!

AT A TOUCH! *NEW KITCHEN DEVICE*

Amazing discovery! Let us send it to you on trial and show you how to make big profits. Works like magic. Cans, Jars, Bottles—any size, shape—opened instantly. Amazingly low priced. Startling demonstration makes housewives buy instantly.

AGENTS Make up to $9 in a Day

FREE SAMPLE OFFER Two magic selling plans pour profits into your pockets. Wonderful spare time money maker. Send name, address, for Free Sample Offer.

MAGIC PRODUCTS CO.
1418 Pendleton Ave., Dept. CW-371, St. Louis, Mo.

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WASHINGTON, D. C.

COLGATE RAPID-SHAVE CREAM

GIVES YOU A SOOTHING SKIN-LINE SHAVE THAT LASTS HOURS LONGER

• ALWAYS READY FOR USE

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BOOKS Air Conditioning—Heating—Sheet Metal Work

First Steps in Air Conditioning	$2.00
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World's most extensive line of sheet metal books. Free Catalogue.

SHEET METAL WORKER 43 WEST 45th ST., NEW YORK

WORLD'S BEST WANT AD MEDIUM

CLASSIFIED Advertisements

POPULAR MECHANICS

Advertisements in this section, 35 cents per word, each insertion, minimum 10 words, payable in advance
To be inserted under proper classification in January issue, copy should be in our office November 8th
January issue on sale December 1st
Popular Mechanics Magazine, 200 East Ontario Street, Chicago, Illinois

YOU'LL PROFIT

By reading and answering the classified ads in this section. Hundreds of opportunities to make and save money.

Popular Mechanics Magazine, Chicago, Ill.

Gentlemen: Over three years ago, after trying many magazines, we decided to place an ad in Popular Mechanics Magazine. We have been very pleased with the results and think you should know about them. Our first ad appeared in the January 1932 issue and we began to receive a flood of inquiries from all over the world. From the United States we have in the past three years received thousands of inquiries. We find that our ad never dies in Popular Mechanics as we receive many replies from ads published in 1933. We are shipping type daily as a result of these ads as we have turned a large number of these inquiries into good customers. As long as we are in business you can count us as a booster of good old "Popular Mechanics."

Yours very truly,
NATIONAL TYPE CO.

(Original letter on file in our office)

AUTOMOBILES

MIDGET Race cars powered with Knuth's specially tuned Harley Davidson motors win. We specialize in speed. Let us soup-up your motor. Send 10c for list of Knuth's Super-Tuned Harley Davidson racing motors, parts, fuel, accessories, etc. Bill Knuth, 2491 W. Fonddulac Ave., Milwaukee, Wis.

MIDGET Powered car plans. Full size patterns and dimensions. Best design. Free consulting service during construction. Postpaid $1.00. Free circular. Derby Midget Car Co., Woodstock, Ill.

SEMI-DIESEL Conversions for gasoline motors, $12.00. Enclose 5c, (stamps or coin) for illustrated literature. Desogas, 1719 Addison, Berkeley, California.

CHEK-CHART For semi-diesel conversion adjustments, 10c. Iron out the "bugs" in your conversion. Free with complete instructions at $1.00. Thousands now in use. Earl Behling, Box 944, Los Angeles, Calif.

AHEAD Of auto industry. Simple operation by anyone on present crankcase oil measuring rod, transforms it into wipeless one. Scientific principle. Plan, instructions 10c. Town Industries, 416 Quincy Ave., Bronx, New York City.

TRAILER Owners! The West beckons! Marvelous scenery and trailerites welcome! Send for sample copy, Western Trailer Trails, 830 Market Street, California. Enclose dime.

NEW Book covering every detail of auto electric system, including magneto ignition. Step by step trouble shooting. Questions and answers. One dollar postpaid. Satisfaction or money refunded. Allen Electric Manual, Box 83, Detroit, Michigan.

GUARANTEED Fuel conversion plans 25c. Technical Supply, 1457 Broadway, New York.

R & R MFG. Co., Anderson, Indiana. Speed equipment for Fords and Chevrolets 25c for catalogue, midgets included.

MIDGET Car plans, parts, engines. Circulars dime. Storms, 13 Southside, Asheville, N. C.

NOW! A money-back guaranteed Diesel converter for automobiles, trucks, tractors, boat engines; complete with fittings only $7.75. (V type engine $10.00.) 5 days trial. Saves up to 70% fuel cost. Easy to install. Send $7.75 money order or $2.00 and pay balance when delivered. Groat Diesel Co., Dept. C, 516 Morgan Bldg., Portland, Oregon.

MIDGET Racing book; facts for fans, builders, drivers; track sizes, regulations; pictures, specifications, working drawings. Also stock car conversions for fastest cars. $1.00 postpaid. $1.12 C.O.D. Ray Kuns, Dept. 20, Cincinnati, Ohio.

AUTO SUPPLIES AND EQUIPMENT

DEALERS, Service station owners, automobile water temperature gauges repaired $1.50. Send all parts. United Speedometer Repair Co., 436 West 57th St., New York City.

"KEEP-KLEEN" Steering wheel covers fit all cars. 75c each. Details free. Robert Kephart, Georgetown, Delaware.

DEMONSTRATORS. Compressor, test bench, 8-hour battery charger—arc welder. Guaranteed. Trial and terms. Ken's Equipment Exchange, Box M-126, Troy, Ohio.

NOW! A permanent and easy way to repair cracked valve seats, cylinder blocks, etc., good as new. Save money. How to do it, only $1.00 for complete technic. Box 146, Boone, Iowa.

USED Auto parts at half price for all cars. Century Parts Co., 1712 Lafayette Ave., St. Louis, Mo.

PLATING Outfits for automobile parts. Connect to battery. No tanks used. Free particulars and proofs. Gunmetal Co., Ave. J, Decatur, Ill.

A. C. GENERATORS

PRACTICAL Changes for automobile generators. See our advertisement at bottom of page 151A. Autopower, Inc.

AUTO TRAILERS

BUILD The famous Jim Dandy cabin trailer—thousands on the road! A roomy, good looking trailer easy to build at low cost by anyone handy with tools. Complete plans and instructions—only 50c—give every detail of chassis, body, top, beds, cabinets, refrigerator, electric light and water systems and where to buy all parts. Can be built in any size to accommodate 2 to 4 people. Send 50c for these practical plans. Rush your order today to Jim Dandy, Box 1125, Wausau, Wis.

TRAILER Owners. The recognized material for attaching fabric to trailer tops and bodies is Ferdico Trailer-Top Cement. Waterproof. Long wearing. Will not check. Complete instructions. L. W. Ferdinand & Co., Inc., 599 Albany St., Boston, Mass.

TRAILER Axles, wheels, springs, equipment. Roberts Trailers, 11429 Forest Ave., Chicago.

TRAILER-ITES! See advertisement of Trailer Travel Magazine on page 69A.

PLAN That Western trip with Western Trailer Trails, new Western trailer magazine. Full of trailer information. Send dime for sample copy. Western Trailer Trails, 830 Market Street, San Francisco, California.

MODERN Streamlined trailer easily built by anyone. Information, plans and list of parts $1.00. Eck-O Trailers, Scotia, N. Y.

"NOW" A Fold-A-Way Trailer. Accommodations equal to those of the more expensive. Write today for particulars. Fold-A-Way Trailer Co., Box 642, Davenport, Iowa.

PARTS For the Popular Mechanics "Family Trailer" featured in the February, March and April issues. Everything you need—Axle, hitch, wheel housings, water tank, pump, toilet, sink, stove, wood parts, windows, screens lights, cushions, etc. Send for price list. Include 25c for our big catalog and Trailer Builders' Manual. Trailer Supply Co., 410 Grand Ave., Wausau, Wis.

MOTORYCYCLES, BICYCLES AND SUPPLIES

CLOSING Out large stock new Indian parts, all models. Discounts to repair shops. Many used parts, all makes. No catalogs. Indian Agent, 3661 Archer, Chicago, Ill.

MOTORCYCLE Tires $3, motor bicycles $45, magnetos $12, clutches, handlebars, belts, chains, wheels $1. Parts lowest prices. Bicycles $12.50, tandems $12. Deninger, Rochester, N. Y.

POWER Your bike with low priced Speedibike motor. Attach in one hour. Eighty miles to gallon. Thirty miles an hour. Free folder. Guaranteed. Outboard Motor Corp., 4044 N. 28th St., Milwaukee, Wis.

"LET Me supply your motorcycle needs." Genuine Harley Davidson parts, accessories, oil. Motorcycle tires, cylinders and pistons re-honed and fitted. Expert repairing, frames and forks straightened. Prompt service. Send 50c for complete parts and accessory catalogue. Bill Knuth, 2491 W. Fonddulac Ave., Milwaukee. Exclusive Harley Davidson dealer.

MOTORCYCLE Bargains, lowest prices, bargain sheets for stamp. Motorcycle accessories. Rochester Harley Davidson Corp., 129 West Main St., Rochester, N. Y.

HENDERSON, Excelsior, Harley, Indian, used parts, alloy pistons, catalogue and wings pin 10c. Ballak, 1115 Chestnut Street, St. Louis, Mo.

SEND 15c For illustrated used motorcycle catalog. Bargains. Largest stock genuine Indian parts and motorcycles. Indian Motorcycle Sales, Kansas City, Mo.

MOTORCYCLES—Direct to you at rock-bottom wholesale prices. Rebuilt, roadtested and guaranteed Indians, Harleys, etc. Send 10c today for "Bargain Bulletin 43." Crandall Hicks Co., 780 Commonwealth Avenue, Boston, Mass.

RECONDITIONED Motorcycles. New and used parts for all makes. Complete service. Whitman Motorcycle & Supply Co., 405-9 Southwest Blvd., Kansas City, Mo.

REBUILT Motorcycles, all makes, new and used. Harley Davidson parts. Send 10c for bulletin. Western, 914 E. 15th, Kansas City, Mo.

AVIATION

PROPELLERS, Sled-lightplane, lowest prices. Literature 6c. Woodcraft Propeller Co., Hillside Station, Wichita, Kans.

PROPELLERS For airplanes, ice sleds, snow sleds. Catalog dime. Lorenzen Propellers, Niles, Michigan.

DON'T Buy anything until you get Ort's Aviation Material Catalogue. Prices are lower. Send thin dime today. (Canada 20c.) Karl Ort, 634 W. Poplar, York, Pa.

PROPELLERS For airplanes, sleds, boats. Get free price-list. Save 50%. Standard Propellers, Fort Worth, Texas.

PREPARE For flying instructions with home studies. For particulars write Freeland Flying School, Pine Brook Airport, Pine Brook, N. J.

USED Airplanes $75.00 and up. Easy payments. Literature 10c. Continental, Box 344, Dept. 2, Indianapolis, Ind.

YOUNG Men interested in entering aviation under transport pilot and mechanics training plan. Write immediately enclosing stamp. Mechanix Universal Aviation Service, Strathmore Station, Dept. D, Detroit, Michigan.

GET Into aviation. Air transport pilots get up to $7,000 per year; mechanics, $2,500. Learn at this government approved school. Write for complete information. State age. Lincoln Flying School, 2004 Aircraft Building, Lincoln, Nebr.

NEW Airplanes, $98.00. Terms. Motors, propellers, air-wheels. Send 25c for information. Hibbs, Fort Worth, Texas.

HUNDREDS Airplanes $75 up. Terms. Complete directory, 25c, postpaid. Aircraft Directory, Athens, Ohio.

BOOKS Covering hundreds of subjects. Big catalog for 3c postage. Popular Mechanics Press, Room (C36), 200 E. Ontario St., Chicago.

BATTERIES, GENERATORS, ETC.

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FREE!! Scarce airmail triangle and fascinating Cayman Islands map stamp; also large Silver Jubilee commemorative (a future rarity!), fine packet hard-to-get countries, including Sudan (desert scene), Epirus (sharpshooter), etc., and, finally, a set of U. S. stamps more than 50 years old. This valuable collection absolutely free to new approval applicants sending 3c postage! Midwood Stampco, Dept. P6, Midwood Station, Brooklyn, N. Y.

MOZAMBIQUE Triangle airmail stamp, jubilees, United States commems., French colonial pictorials, China's midget stamp and packet of 30 different, stamp tongs, lists, all for 10c to approval applicants. Sierra Stamp Co., Box 73, Fontana, Calif.

SILVER Jubilees, Newfoundland, Canada included in our packet of 50 different British, 10c to approval applicants. Lists free. Mantle Stamp Company, London, Canada.

ABSOLUTELY Free! Scarce mint United States telegraph stamp, cataloging 50c, and our big 56-page illustrated catalog, "United States, British North America and Foreign Stamps." Write today! H. E. Harris & Co., 137-G Transit Building, Boston, Mass.

UNITED States commemorative, more than any other group of stamps increase steadily in value. Regularly every year they advance in price and are harder to obtain. The beautiful Byrd South Pole and imperforated 1c and 3c Parks for instance went up 30% since last year. We offer these together with 7 other United States commemoratives, including one over 40 years old, for only 10c to approval applicants. Only 1 lot per person. Approval Headquarters, Globus Stamp Company, 268 - 4th Ave., Dept. 50, New York, N. Y.

BARBADOS Animal, Eritrea beast, Toga pictorial, Abyssinia mint included packet 54 different with approvals. 6c. American Stamp Company, Frankfort, Ohio.

AIRMAIL Triangles from Liberia and Mozambique, 3 British silver jubilees, new King Edward stamp and packet 25 different stamps from Azerbaijan, China, Ukrania, etc. All for 5c to approval applicants. Clipper Stamp Co., Dept. 7, Gloucester, Mass.

BADEN, (Scarce German state), Mongolia, Georgia, $5 U. S., Azerbaijan, Caymans, Transcaucasian Federated Republic—everything absolutely free to approval applicants enclosing 3c. Viking Stamp Co., 1-Z Hanson Place, Brooklyn, N. Y.

VALUE Instead of premiums. Approvals ½c up. Viscusi, Route 4, Scotia, N. Y.

RARITIES Of the future. Beautiful Queen Astrid memorial, Von Hindenburg mourning stamp, assassinated King Alexander mourning stamp and costly railroad commemorative stamp of Germany together with obsolete Piccard stratosphere balloon flight commemorative. All for only 10c to approval applicants. Lorwin Stamp Company, 1327 Roosevelt Boulevard, Philadelphia, Pa.

WANTED—Good conditioned United States stamps on original envelopes before 1880. No dealers. M. M. Green, Box 224, Back Bay, Boston.

FREE—15 Different Peru to approval applicants enclosing postage. Ranson, 3555 Fullerton, Chicago.

FREE—Eight beautiful airmails to approval applicants enclosing postage. Green & Co., Norwood, Ohio.

LOOK! 25 Different Japan, large Mongolia, $1, $2, $4, $5, $10 U. S. revenue, only 5c to approval applicants. Clarence Yuchartz, 435 Sycamore St., Dept. A, Wyandotte, Michigan.

4c DIEGO Suarez 1892—Free! Superior approvals! Sets! Singles! References please. Old Gold Stamp Shop, Iowa City, Iowa.

166 U. S. Commemoratives, etc., 10c; 500, 25c. Box 457, Newark, New Jersey.

$1.00 POSTAGE Due free. Unbeatable United States. Approvals. Nelson, 658 Laurel, St. Paul, Minn.

VALUE! 100 Different U. S. 30c. 250 foreign 10c. Stamp House, Wenatchee, Washington.

ROMAN States. Seven different copies cataloging $18.25! Only 10c, with approvals! National Stamps, 1140 Gower, Los Angeles.

FREE. 25 Different Italy to approval applicants. Harlan, 5307 S. Marshfield, Chicago.

25 DIFF. Stamps on old album page, 10c. McKay, 7200 Yale, Chicago.

½c UP Approvals, 100 samples 5c. Eisinger, 766-M Fox Street, New York.

50c STARTS New stamp business. Particulars, sample, 15c. Sparetime, Box 71, Norfolk, Va.

ASK For our wonderful one cent approvals. Prospect Stamp Co., 225 Broadview, Toronto, Canada.

APPROVALS — United States, foreign, new issues. Huber, 3 South Eighth, Minneapolis.

200 DIFFERENT 15c; 300, 25c; 500, 50c; 1,000, $1.00. Charlie Seifert, 1352 Buttonwood, Reading, Penna.

50 VARIETIES U. S. 12c. Approvals sent. Elmer's, 196A Washington St., Boston, Mass.

1000 HINGES 5c. Bargain approvals included. V-J Sales, 2729 N. Summit, Milwaukee, Wis.

BELGIUM'S Queen Astrid set, complete 50c. Approvals. Turner, Box 157, Monrovia, Calif.

AUSTRALIA. New Zealand. Approvals. Dollar deposit. "Gower's Stamp Den," Adelaide, South Australia.

MIDGET Airmail (½ in. tall), Szchuen, Kouang-Tcheou, Mozambique, etc., 30 stamps—5c Depraw, Ocean Park, California.

1000 STAMPS, Mostly U. S., 20c. Auburn Stamp Co., Bridgeport, N. Y.

U. S.—57 Different (commemorative, airmail, etc.) with approvals 9c. Moseley, 4932 Forestpark, St. Louis, Mo.

200 DIFFERENT Foreign stamps. Dime. Star Supply Company, Lima, Ohio.

SEVEN Greece airs 10c with approvals. Parche, Box 1268, New Orleans.

FREE Premiums to approval applicants. References. P. McKinney, Elsie, Mich.

$5.00 U. S. Postage due, No. 2284, fine copy 5c with general approvals. Hudson Company, 116 Nassau St., New York City.

NEWFOUNDLAND, 15 Different 5c with approvals. Hudson Company, Plainfield, N. J.

BRITISH Colonies! 25 different, 5c. Approval applicants. Starstamp, 3218 204, Bayside, N. Y.

FREE—6 Different silver jubilees, with approvals. Send 3c postage. Berg, Linwood Station, Detroit.

SELECT Latin Americas 25c. Essemell, 1827 So. Millard, Chicago, Illinois.

TANNOUTOUVA Triangle, Manchukuo, Charkhari, Mongolia, Malay, 40 Asia 5c. Approvals. Ferguson, Ridley Park, Penna.

FREE—25 Different, Peru, Fium, Nicaragua, Ecuador, Italian comm., with approvals 3c. Arrow, 5228 So. Paulina Street, Chicago.

7 IMPERFORATE U. S. commemoratives including Chicago, Byrd, Farley reissue and 23 North American stamps. Retail value over 75c—all for 25c to approval applicants. Illustrated pricelist free. Curhan Stamp Co., Dept. P, Gloucester, Mass.

STOCK Clearance — Includes airmails, jubilees, sets 50—10c, 600—$1.00. Brooks, 373C Fifth Avenue, New York.

U. S. WHOLESALE List, 3c postage to serious buyers only. Large stock used—reasonable prices. List ready within about 6 weeks. Send for it now!! Continental Stamp Co., 5435-P 24th Street, Cicero, Illinois.

WORTHWHILE Collection — Airmails, commemoratives, jubilees, classics, pictorials, Eritrea, many others. 10c with approvals. Clatworthy, Upland, Calif.

U. S. APPROVALS Moderately priced. Price list on request. Stamp Mart, 946 McKnight Bldg., Minneapolis, Minn.

U. S. COMMEMORATIVES—35 Different. A real bargain—only 25c. Fine approvals if requested. Crystal Stamp Co., Box 64, Racine, Wis.

UNPICKED! 100 U. S. revenues on original documents—10c! Vanvoorhis, Hyndman, Pennsylvania.

CANNON! Set of stamps showing cannon, firing squad, cavalry charge and 200 other different stamps only 10c to approval applicants. Paramount Stamp Co., 4225 Broadway, Chicago, Ill.

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CANADA—100 Stamps 25c, $1.00 value. Deneve, 3439 St. Andrew, Montreal.

UNITED States price lists. Mailed with imperforates for 10c. Adam Bert, 522a Park Building, Pittsburgh, Pa.

UNITED States, 100 different 40c, 175 different $1.15. Fabian, Onderdonk, Ridgewood, New York.

WORLD'S Largest triangle! Giant Spain triangle and bi-colored Persia airmail; big packet 25 different Russia (catalog value nearly $1.00); packet British Colonies including Egypt, Travancore, Ireland, Malay, etc. Big United States list. All for only 5c to approval applicants. Fidelity Stamp Co., 920 Earle Bldg., Washington, D. C.

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AIRMAIL Or general approvals. Fine. Clark, 1612 Dial, Springfield, Illinois.

FREE! Metal perforation gauge to approval buyers. Buckey, 208 Ludlow Bldg., Dayton, Ohio.

25c MAGNIFYING Glass, 5c with approvals. Aladdin, 1550 Carroll, St. Paul, Minn.

RARE Mint Newfoundland commemorative, 23 different Russia. Poland's astronomical commemorative, Jugoslavian war horror, Denmark 1921 issue, United States telegraph set, all complete; 42 stamps cataloging $2.93 only 25c. Friendly Filatelists, 3615 N. Sydenham, Philadelphia, Penna.

100 DIFFERENT Foreign, three nickle packets, one dime packet, regular 35c value, only 10c. Skillman, Titusville, N. J.

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MAMMOTH Mystery packet rare stamps only 10c to serious approval applicants, also valuable free premiums with every selection afterwards. Our stamps are better, our service is different. Fair-Play Stamp Service, 1215 Browning Blvd., Los Angeles, Calif.

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SILVER Jubilees—15 different 25c. World specials—500 different 35c, 1000 different $1.00, 2000 different $3.00. These offers to approval applicants only. List free. Victoria Stamp Co., London 4, Canada.

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STAMP Dealers, your ad here will bring wonderful returns. Ask me for proof. F. W. Johnson, Manager, Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

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SCARCE "New issues" packet! New giant sized, diamond-shaped Russian "sports" stamp; Nyassaland "leopard"; Morocco; Tanganyika, and other scarce countries are included in our big packet of new and recent issues—stamps most collectors have never seen! Get this valuable packet today. Only 5c to approval applicants. Reimers, 115 Flatiron, Fort Worth, Texas.

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300 DIFFERENT 20c; 1,000, $1; 2,000, $3.00. Fred Onken, 630 79th St., Brooklyn.

107 DIFFERENT; Algeria, Gabon, Newzealand, Guinea, Congo, etc., 5c to approval applicants. Extra—Airmail packet free!! Hunziker, Box 225H, Minneapolis, Minnesota.

44 DIFFERENT United States including $5 stamp, or complete set United States bicentennials, or 30 different obsolete Canada, 13c postpaid with approvals. C. A. Lennan Co., Box 322, City Hall Annex, New York, N. Y.

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ANNUAL Wholesale catalogue—Illustrated and enlarged. Free upon application. Empire Stamp, Department 5, Toronto, Canada.

25 UNITED States, including $4 and $5 stamps free to approval applicants. 3c postage. Brownie Stamp Shop, Flint, Michigan.

DIAMOND-SHAPED Stamp, Liberia gunboat triangle, two other triangles, silver jubilee, 27 others, 5c. Crowder Company, 127E North, Baltimore, Md.

FREE!!! King George memorial packet, 15 varieties. Postage 3c. Roberts 901F Fourth, Baycity, Michigan.

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WEEKLY Stamp magazine, thirteen weeks, 10c. Stamp Journal, Kalamazoo, Mich.

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PENNY Approvals, that satisfy. Neil Gronberg, Box 5441-P, Philadelphia, Pa.

FREE Hinges, stamps, gauge, with approvals. GSCO, 613 Parrish, Philadelphia.

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20 REPRINTS 25c—Films developed, 16 prints 25c. Enlargements 8x10—25c; 5x7 10c. Low Photo, M-2657 Neva, Chicago.

SENSITIZED Xmas cards in colors all ready to print a photo on. The latest idea, ten for dollar, assorted. The only colored Xmas cards on market. Leroproducts, 1612 Neptune, Brooklyn.

DEVELOP And print your own pictures. Save time, money with our complete $1.49 outfit postpaid, or pay postman $1.55 COD. Includes electric ruby lamp, printing frame, photo paper, chemicals and equipment. One of hundreds of amazing bargains in our free, newest, money-saving bargain book. Send for it today! Central Camera Co., 230 So. Wabash, Dept. K-112, Chicago.

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ROLLS Developed, 116 size or smaller, eight beautiful enlargements, no small prints, 25c (coin). LaCrosse Photo Works, LaCrosse, Wis.

MAIL Your rolls to The Kodak City. 8 guaranteed glossy Velox deckle-edged prints, 25c coin. Two professional enlargement coupons free! Photo Finishing Shop, Est. 22 yrs., 411-C Genesee Valley Trust Bldg., Rochester, N. Y. "The Kodak City."

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SOLEX Sensitizer reproduces any negative on fabrics, Xmas cards, etc. No dark room or experience required. Permanent, washable. Trial size 25c. Lynmore Company, Gravesend Station, Brooklyn, New York.

ENLARGE Those summer snapshots! Complete photo-enlarger plans, instructions, 25c coin. Hoffmann, 218 Etna Street, Brooklyn, N. Y.

ENLARGEMENTS. 8x10 Double-weight 25c. Cardinal Photors, Berkley Heights, N. J.

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COLORED Reprints 2½c. Rolls developed, printed, colored, 25c. Weick, 2840 Zenobia, Denver, Colorado.

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QUALITY Counts—Two double weight gloss enlargements and eight prints guaranteed not to fade from each roll, 25c. Prompt service. Excel Photo, Box D, Dubuque, Iowa.

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SPRING Motor 8mm. movie cameras $9.95 new. Motor driven 200-ft. 8mm. projectors $12.50 new. 30 ft. film for above cameras 60c. Spring motor 16mm. camera takes snapshots, movie books, 16mm. movies. $5.95 brand new. Films 35c up. Projectors $1.00 up. Send no money. Pay postman. Free lists. Home Movies, Box 32, Easton, Pennsylvania.

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SOUND Road show specials. Lists 3c. Lakeshore Film Service, Michigan City, Ind.

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35MM. TALKIES, Silents. Bargains. Lists 3c. Paul Oakley, Nelsonville, Ohio.

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NEW Remarkable foot powder! Results are amazing. Guaranteed. Fast, repeat seller. 100% profit. Everybody buys. Send dime for sample and particulars. Cooper Products, Flushing, New York.

NO Boss! Sure cash! Silvering mirrors, autoparts, reflectors. Combination outfit. Write Sprinkle, Plater, 128, Marion, Ind.

BE Your own boss! Operate used-new clothing business from store, home, auto. 200%-300% profit. Everything furnished. Catalogue free. Portnoy, 566-G Roosevelt, Chicago.

AGENTS! Dresses 33c, men's suits $1.50-$2.00, shirts 46c, ties 6½c, chiffon hose 42c. Amazing prices. Big profits. Catalogue free. Liquidation, AB-550 East 43rd, Chicago.

MEN! Women! No dull times selling guaranteed food products. Regular customers. Steady income. Experience unnecessary. Free sample. Write today. Federal Pure Food Co., G-2944 Lake St., Chicago.

AGENTS—Lowest prices—Top profits on carded aspirin, razor blades, handkerchiefs, laxatives, shoe laces, etc. Details free. Better Products Co., Dept. 2711, Marion, Ind.

WANTED—Monument salesmen. Men, ladies make good money. Outfit free. Write Factory Manager, A-23, Oneco, Florida.

WHOLESALE Catalog free, 500 best sellers. Paty Co., 1167 Broadway, Somerville, Massachusetts.

300% PROFIT In new self-starting no-flint cigar lighter. Retails 50c. Sample 25c. Get details quick on wonder seller. New Method Co., Box PM-48, Bradford, Pa.

5c WILL make you 75c profit. Free sample of product. Free literature. Stanley Products, Lansing, Mich.

MAKE Up to $12 day with sensational extract deal. Everybody buys. Particulars free. Wyatt, Box 2322, Houston, Texas.

450% PROFIT In new automatic gas lighter. No flint or flame. Lights gas instantly. Retails 25c. Costs you $1.00 a dozen or 15 dozen for $8.00 postpaid. Sample 10c. New Method Co., Box PMG-48, Bradford, Pa.

SUCCEED With your products. Make-sell them. Formulas. Processes. Accurate analyses. Catalog free. B. Thaxly Company, Washington, D. C.

WHY Work for others? Make and sell your own goods. Formulas, toilet articles, perfumes, extracts. Valuable book free. Scientific Laboratories, 1950W Broad, Richmond, Va.

AMAZING New scientific discovery cuts coal bills over 50%. 75c package treats a ton. Every home and building a prospect. Agents cleaning up. Call or write. Marvo, 360 49th Street, Brooklyn, N. Y.

HERE'S Real new money-makers. Sell carbon papers and typewriter ribbons at big money savings! Continuously used every day by offices, stores, factories, schools, etc. Splendid side item for printing and greeting card salesmen and everyone who calls on stores, offices. Write for handsome Free pocket size sales outfit. Greengard's, 203 North Wells, Dept. C8, Chicago, Ill.

AGENTS—Wanted to sell ladies' or men's belts, suspenders, neckwear, make $10 daily, full or part time. Schulman, 408 East 5th St., New York.

AMAZING Finish, thousand uses. Sells itself. 150% profit. Sample 10c. King, 612 N. Michigan, Chicago.

SHOP Agents wanted for famous line Vernier calipers. Free catalog. George Scherr Company, 120 Lafayette, New York.

SELL Neon signs and window displays. Big demand. Large profits. Write McGinnis Signs, Rice Lake, Wis.

500% PROFIT! Gold reflecting letters for store windows. Large sizes 1c. Free samples. Modernistic Sign, B-3004 Lincoln Ave., Chicago.

AGENTS Wild about our flash-light screw driver, Nite Lite pencil (writes in the dark) and Pen-Lite Flash-light. Samples 60c each, $7.00 dozen. Big Christmas sellers. Particulars free. Mead Company, Middletown, N. Y.

BIG Money. Commissions daily. Free clothing. Sell quality raincoats, jackets, overcoats. New styles—Lowest prices. Sales kit free. Goodwear, 712-AA Roosevelt, Chicago.

ENGRAVED Name plates, numbers, signs, etc., easily sold, profits large. Brett Bros., Winthrop, Mass.

I'LL Give you groceries at wholesale besides splendid opportunity to make up to $45.00 in a week. Brand new Ford sedan given as bonus. Details free. Albert Mills, 2912 Monmouth, Cincinnati, Ohio.

TIES, Pencils, shoe laces, razor blades, all big sellers. Send for catalog. Heil Premium Co., M-8, Gaylord, Minn.

PROFIT With new products. Make, sell, repeat. Analysis. Research. Guaranteed formulas. Biggest catalog free. Special prices, leads. Gibson Laboratory, Chemist, BD-1142 Sunnyside, Chicago.

SANTA Claus that talks. Magic, mysterious. Works like phonograph. Fascinating. Sample 30c. Talkie Toy Company, 4451 Irving Park, Chicago.

MEXICAN Feather pictures. Christmas novelty, 50c (stamps) bring $2.00 worth samples, details. Refund if unsatisfied. Mexican Art, Apartado 1593, Mexico City.

YOUR Favorite cigarettes free! Selling tinseled Thanksgiving-Christmas signs! 11"x14" costs 5½c—retails 25c. Sample free. 21 boxed Christmas cards 35c—retails 85c. Lowy, Department 673, 8 West Broadway, N. Y.

DISTRIBUTORS Make 700% profit. Amazing new quick bandages. Beautiful 4-color packages, cellophane wrapped. A quick seller and sure repeater. Get started now. Send today for trial order. Dozen, $1.00; gross, $10.00. Quick Bandages, 912 Blackhawk St., Chicago, Ill.

SOMETHING New—Agents cleaning up profits first day. Sure fire sellers. Send for information at once and start making money for Christmas. Chester Chemical Co., 140 Morris Ave., Summit, N. J.

SELLS On sight. Skyrocket strawflowers. Beautiful decorative house plant. One dollar. Sells for $2.50. Ideal Christmas gift. Rice, 135-15 227th, Laurelton, New York.

CALIFORNIA Sun dried fruits—nuts. Hollywood Health Products, Box 348, Hollywood. Sample Box 99c. Particulars.

SELL Comic Christmas seals. Sample set 10c. Rogge, Grayslake, Illinois.

625,000 SPECIALTY Items. Sell cheap. Lists 10c. Duffy, Covington, Ky.

MAN In each town to plate auto parts, reflectors, bathroom fixtures, refinish beds, mirrors, chandeliers, by late method; experience unnecessary. Simple plan of manufacturing at home starts you in big money making business. Free particulars and proofs. Gunmetal Co., Ave. H, Decatur, Ill.

MAKE More money selling shirts, ties, underwear, dresses, hosiery, raincoats, jackets, pants, uniforms. Sales outfit free. Nimrod Company, Department 8, 4922-28 Lincoln Avenue, Chicago.

GENUINE Gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

MONOGRAMMING Automobiles biggest money maker today. New type requiring no varnish to apply. Write for samples. International Monogram & Transfer Co., Box 6365, Philadelphia, Pa.

BUY Wholesale 1000 bargains. Catalog free. Products Company, Gary, Indiana.

BIG Money applying gold initials on automobiles. Easiest thing today. No experience needed. Free samples. "Ralco," 1084 Washington, Boston, Mass.

FREE Sample—Amazing cleaner; sells homes, taverns, everywhere. Big profit—fast repeater. Betco, 5007 Irving Park, Chicago.

STOP Squealing—Start crowing!! Drive to country — "movies" — afternoons. Work mornings—home. No canvassing! National Folio-A, Station "D," Los Angeles.

SELL Novelty fun cards, novelties, etc. Samples 10c. National, Box 500M, Cincinnati.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge $1.50, make $1.45. Ten orders daily easy. Write for particulars and free sample. American Monogram Company, Dept. 40, East Orange, N. J.

AGENTS—Opportunity to make money; book containing 107 successful business plans; home or office; send for free introductory booklet. Elite Co., 214 Grand St., New York.

AGENTS Mosco corn and callous remover will build you a steady repeat business. Send today for pocket-size trial outfits. The Moss Company, 64 Searle Bldg., Rochester, N. Y.

COSTS 1c—Sells 25c. Make non-explosive cleaner from benzyne crystals. 1c gallon. Sample 10c. Literature free. Western Reserve Laboratories, 6615 Denison Ave., Cleveland, Ohio.

WANTED—District purchasing agents. No experience or money required. Write Purchasing Manager, 174 N. Halsted, Chicago.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents" is filled with proof. I'll gladly send you a copy free. F. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

SALESBOARD Men—New put and take jars. Details, samples free. Tom Thumb, Dept. PM, Nauvoo, Ill.

GUARANTEED Double-edged blades 50c hundred up. If there's anything else you want, write us; we have it. Samples sent. Steven Spencer, 412 E. 51, Brooklyn, N. Y.

PROFITABLE Home business. Legitimate. No canvassing. Maywood Publishers, P-923 Broadway, New York.

BIG Profits eyeglass necessity. Cleans, polishes, prevents steaming. Sample ten cents. Shurberg Chemical, Hartford, Conn.

GOLD Reflecting letters for store windows. Easily applied. Large sizes, penny each, free samples! Atlas Sign Works, 7941 Halsted, Chicago.

BOOKS Covering hundreds of subjects. Big catalog for 3c postage. Popular Mechanics Press, Room (C36), 200 E. Ontario St., Chicago.

HIGH-GRADE SALESMEN

DON'T Be a job hunter—Start your own business on our capital. No hard times; no lay-offs; always your own boss. Hundreds average $3,000 to $5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary. Wonderful opportunity to own pleasant, dignified, profitable business backed by world wide industry. Write Rawleigh, Dept. L-U-PPM, Freeport, Ill.

SALESMEN—To handle the Simplicity line of motor rebuilding equipment. Established territories available for high grade men, commission basis. Simplicity Mfg. Co., Port Washington, Wis.

LIVE Wires, earn excellent pay and bonus selling tear gas fountain pen guns. Zeppelin Arms, Dept. 102, Akron, Ohio.

BIG Money maker! Amazing invention closes all doors silently, automatically. New oil principle. Easily installed. Never needs attention. Priced dollars less than other checks. Unlimited market stores, offices, factories. Free demonstration furnished workers. Kant-Slam, Dept. L-62, Bloomfield, Ind.

BIG Money makers: Large line work uniforms, raincoats, pants, shirts, etc. Advertising embroidered. Low prices. Every business, individual prospect. Free outfit. Dove Garment Co., 1733 Milwaukee Ave., Dept. 905, Chicago.

CALL On gas stations, garages, stores. New chemical sponge whirlwind seller. Cleans automobiles without work. Phenomenal profits. Outfit free. Kristee, Dept. 261, Akron, Ohio.

NEW Punchboard line. Free 32 page full color catalog. Nothing to carry. Larger cash commissions daily. Season now! Lea-Moore Co., 180 Adams, Chicago.

SALESMEN: $5 To $10.00 daily possible. 2000 business cards $1.50; 1000 20 lb. letterheads $3.00. Your commission 33⅓ percent. Free sales kit. Star Publishing Company, Dept. 2-P, Corsicana, Texas.

SELL Guaranteed radios. Buy at wholesale as low as $6.70. Resell at 50% profit. Moneyback guarantee. Catalog free. Send 10c for give-away" plan—make $10.72 on every deal. Silver Sales Co., Dept. P, 612 N. Michigan, Chicago.

BRAND New grab-bag deal. Going big everywhere—big profits—swift sales—fast repeats. No restrictions. All dealers buy. Act! K&S, 4347-D Ravenswood, Chicago.

HUSTLING, Responsible distributors wanted through out U.S.A. to handle fast selling automobile necessity. Opportunity to right men for large earnings. Excellent territory available. Write immediately. Accessory Sales, 3333 Madison, Chicago.

WANTED: Reliable, energetic salesman who knows farming, to sell Martin poultry buildings and corn cribs direct to farmers on easy terms. Big profits—permanent income. Martin Steel Products Co., Dept. 8, Mansfield, Ohio.

COMMISSIONS To $100 weekly. Live leads. Write Morgan Specialists, 8709 Morgan, Chicago.

GIANT Numbered advertising receipt business cards. Free samples. Waldo Press, Box 266, Dallas, Texas.

ADVERTISING Specialty and printing salesmen—Sell food market signs. Profitable repeat business. Gaskill Signs, Box 384, Asbury Park, N. J.

"SPARK Plugs." Sell genuine Tungsten hot and cold spark plugs, give sand-blast cleaner and eight piece wrench set free, with each 50 plugs. Four easy orders daily pay you $120 weekly. Tungsten Factory, 1402 So. Michigan, Chicago.

EXCLUSIVE! Amazingly complete—Advg. match book line. Factory direct. Big comm. Full or part time. Free samples. Experience unnecessary. Match Corp. of America, Dept. E-12, 6041 Grand, Chicago.

SALESMEN-AGENTS. Free. Join Direct Selling Legion, world's largest organization of salespeople. Founded to raise standards of direct selling and afford full service and protection. Button, Gold Seal identity card and monthly magazine free. No fees, dues or assessments at any time. Send name and address today for membership application. Direct Selling Legion, Dept. AD, 307 N. Michigan Ave., Chicago, Ill.

MAN—Handle regular store route. Place nationally advertised 5c-10c counter card mdse. New aspirin deal—6 tablets 5c. 85 other fast sellers. 100% profit. No investment. Samples free. World's Products Co., Dept. 12810, Spencer, Ind.

MAKE Big money — Commissions advanced, sell Popular Mechanics work shoes —complete line dress shoes. Outfit free. Dura-Tex Shoe Co., 90 Brockton, Mass.

GIVE Away free, 1937 short wave and home radios, also full electric automobile radios with our unique "Punch Sales Card Plan." 2 sales daily pays $203.88 weekly profits. Write for our free starting offers. DeLuxe Mfg. Co., Dept. 288, 173 W. Madison, Chicago.

SALESMAN Calling on factories to sell rebuilt belting made from customer's used leather. Thames Belting Co., Norwich, Conn.

SALESMEN: Everybody now buying book matches, labels, salesbooks, garage forms, blotters, calendars, Xmas cards, business stationery, etc. Free deals. Wonderful sideline. Comm. daily. Sales portfolio free. Willens, Dept. PK, 2130 Gladys, Chicago.

WANTED County dealer: Man with car to demonstrate and service for large manufacturer. First class job. 248 Fyr-Fyter Company, Dayton, Ohio.

MAKE More money selling shirts, ties, underwear, dresses, hosiery, raincoats, jackets, pants, uniforms. Sales outfit free. Nimrod Company, Department 65, 4922-28 Lincoln Avenue, Chicago.

SALESMEN—Sell calendars. Complete line, all sizes, including jumbos; beautiful subjects. Samples free! Flemming Calendar Co., 6543 Cottage Grove, Chicago.

BRUSH Salesman—If you ever sold brushes write for our money making proposition. Donald Brush Co., Camden, New Jersey.

NEW Specialty—Sells every business and professional man. Four $15 sales daily pay $280 weekly. Ferrell cleared over $1,000.00 monthly. Write, F. E. Armstrong, President, Dept. PM, Mobile, Ala.

FREE Booklet describes 107 plans for making $20-$100 weekly, in home or office, business of your own. Elite Co., 214 Grand St., New York.

SALESMEN—New deal guarantees stores $10 for one. Two $15 sales net you $20 daily. Sayers, 2801-123 Sheffield, Chicago.

BE Your own boss. Make the largest commissions selling our complete line of brushes. Write for sales plan. Wire Grip Sanitary Brush Corp., 220 Southern Boulevard, N. Y.

SOMETHING New in fire extinguishers—Red Comet Automatics. Proved in west five years. Exclusive territory. Low price opens pocketbooks. Write, Red Comet, 404 Comet Building, Littleton, Colorado.

BE Independent. Own your business; experience unnecessary, selling $10,000 accidental death, $50 accident; $25 sick weekly benefits—$10.00 yearly. Other amounts proportionate. Guaranteed steady renewal income. $726,415.63 securities deposited. Universal Policy, 716-A Lefcourt Bldg., Newark, New Jersey.

EDUCATIONAL AND INSTRUCTION

LEARN Tool and machine designing. Plenty of jobs. Learn the practical side. Six months instruction equal to three years of experience. Low rates, no contracts. Pay as you learn. The Tool Engineering Co., 630 N. Taylor Ave., Oak Park, Ill.

IF you like to draw—Write for talent test (no fee). Give age and occupation. Federal Schools, Inc., Dept. P126, Minneapolis, Minn.

LEARN Law in twenty minutes per day. Credit extended. Holmes Institute, Marquette Building, Milwaukee, Wisconsin.

LEARN Massage-Physiotherapy, nursing, big opportunities. Free literature. Crandall Institute, York, Pa.

GOVERNMENT Jobs. Start $105-$175 month. Men-women. Prepare now for next announced examinations. Experience usually unnecessary. Full particulars—list positions, free. Write today sure. Franklin Insittute, Dept. S3, Rochester, N. Y.

BECOME An investigator—Secret service agent. New "Test Problem Method." Develops your ability. Particulars free. International Secret Service Institute, (PM-126), Hoboken, N. J.

FLORIDA Hotel positions. Instructions. Lee Institute, 176 Mystic, Somerville, Mass.

LEARN Piano accordion. Quick method by mail. Stamped envelope for particulars. Giggy, 5201 Bernard, Chicago.

BE A transcontinental bus operator. Travel. Earn $175-$250 monthly. Complete preparatory course. Prepaid on receipt of $1.00. Superintendent, 1059 East 76th St., Chicago.

13 KNOCKOUT Blows without fists, by internationally known police instructor. Send 15 cents, coin or stamps. S. J. Jorgensen, 400 Maritime Bldg., Seattle, Wash.

PERSONALITY Developed. My booklet tells how. 25c (stamps or coin). P. Jones, 769 St. Mark's Ave., Brooklyn, N. Y.

SECRET Service. Particulars free. Write immediately. George Wagner, M-2640 Broadway, New York.

BIG Bargain catalogue educational matter 10c. Hanfling, Y-799 Broadway, New York.

BE A Radio announcer. Learn at home. Free information. Write Radio Arts Academy, 3819 Wilshire, Holylwood, Calif.

MATHEMATICS, Arithmetic, algebra, geometry, trigonometry, drafting, architectural, airplane, mechanical, ship, structural, surveying, blueprint reading, engineers licenses. Colleges, Cooper Union, tutored by licensed professional engineers. Days, evenings. Mondell, 112 W. 42nd, New York.

AIR Conditioning and refrigeration. Learn these trades that know no depression. Resident or extension courses. For opportunities in these lines write to Detroit School of Refrigeration and Air Conditioning, 4125 Grand River, Detroit, Mich.

CODE Machines. Quick automatic home teacher. Booklet. Terms. Omnigraph, 810E39, Brooklyn, N. Y.

GET A government clerk job. File clerk, P.O. clerk, statistical clerk—all good jobs. Men-women, age 18-50. Want to qualify for next entrance test? Details free. Write, Instruction Service, Dept. 101, St. Louis, Mo.

REPAIR Upholstered furniture. Illustrated course of instruction, including a full set of upholsterer's tools $7.50. Money returned if not satisfied. M. Swider, 260 19th St., Brooklyn, N. Y.

BE An investigator. Earn big money—Travel. Crime detection newspaper and particulars free. National System, 425-G, Fremont, Nebraska.

MEN Wanted willing to learn landscape designing and fill big paying position as landscape architects. Free test of your natural ability and chance to win in $750 contest. No experience needed to start. Earn while you learn. Write today for free test blank. American Landscape School, 400 Plymouth Bldg., Des Moines, Iowa.

LEARN Machinist trade, tool, die making. Automatic and hand screw machines. Modern shop methods. Actual work. Jobs open for trained men. Employment help. Illustrated booklet free. Allied Screw Machine Company, 601 Lake Street, Chicago.

LEARN Auto mechanics, body, repairing, welding, electricity, refrigeration, Diesel. Stevinson's, 2008A Main, Kansas City, Mo.

LEARN Latest methods solving arithmetical problems quickly. Frederick A. Smith, 2410 Smalley Court, Chicago.

STAMMERING, Stuttering corrected. Write Lewis Institute, 12052 Woodward, Detroit, Michigan.

HOME Study courses leading to degrees: Arts and sciences, philosophy, education, law, letters, theology, psychology, engineering, chemistry, business and commerce. Many others. McKinley-Roosevelt University, Chicago.

U. S. GOVERNMENT Positions. $1700-$1900 and up a year. Let our expert (former government examiner) prepare you for a position in the railway mail service, rural carrier, post office, customs and other branches. Write today for free booklet. Dept. 8, Patterson School, Rochester, N. Y.

CHIROPODY Taught by correspondence. Evans School of Chiropody, Montgomery, Alabama.

CARTOONING—COMMERCIAL ART

ART Course. Study cartooning, illustrating, advertising under professional guidance, 50c lesson. First lesson free. Victor Hundgen, 2130 Tiebout Ave., New York City.

CARTOONISTS! Markets, syndicates, professional secrets—10c. Cartoon Studios, LaCrosse, Wisconsin.

AMATEUR Cartoonists can earn $35.00 weekly, spare time, duplicating cartoon advertisements. 3-M Syndicate, Argyle, Wis.

DRAW—Sell cartoons! Miniature cartoon course, 100 illustrations, 25c. Graphic, Box 274A-R2, Phoenix, Arizona.

CHALK Talks. Laugh producing program, $1.00. Catalog free. Balda, The Cartoonist, Oshkosh, Wis.

CARTOONING Course:—30 lessons, over 500 illustrations, drawing pens and pencils, $1.00 complete. Scovell Studios, Box 748-P, Hollywood, Calif.

CARTOONING, Sketching, etc.—46 lessons, 600 illustrations, including practice sheets, pens, pencils. $1.00 complete. Fraba Service, Cashton, Wisconsin.

MAKE $25.00 Weekly duplicating advertising cartoons. Write. Paisley-K, Kinloch Bldg., St. Louis, Mo.

BOOKS Covering hundreds of subjects. Big catalog for 3c postage. Popular Mechanics Press, Room (C36), 200 E. Ontario St., Chicago.

ADVERTISING AGENCIES

ADVERTISING Placed anywhere. Helpful, free service. Rate guide book free. Baker Advertising Agency, 189 W. Madison, Chicago. Successors to Ankrum Advertising Agency. Established 27 years.

LEARN Advertising quickly at home. Easy practical plan. No text books. Common school education sufficient. Interesting booklet and requirements free. Page-Davis School of Advertising, 3601 Michigan Avenue. Dept. 3432, Chicago.

INCH Display advertisement 30 magazines year $24. Wood's Popular Service, Atlantic City, N. J.

ADVERTISE Profitably: $15 reaches 6,000,000 Sunday newspaper readers with 24 word ad. Newspaper, magazine rate-guide, free. Chicago Union Agency, 20 West Jackson, Chicago.

FREE—New Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

FOR ADVERTISERS

ATTRACTIVELY Painted signs, 3 colors, lengths to 25 feet, yard wide paper, $1.50 cash postpaid, sign cloth $2.59. "Edwards," Galena, Ill.

ADVERTISING Thermometers produce! Details? Samples? Holterbach, 11442 146, Jamaica, N. Y.

NEW Live salesman's and inspirational magazine. 15,000 circulation. Classified rate 4c per word. Send a trial ad now. Sample copy free. Mutual Crusader, Berwyn, Ill.

ADVERTISE: 24 Words in 250 newspapers $10. Lists free. Advertising Service Bureau, 4258-C Drexel, Chicago.

BUSINESS SERVICE

REAL Live opportunity seekers names, copied from original letters. 1000 for $3.00. Guaranteed 100% correct. Armour Organization, Flushing, New York.

WHERE To buy anything! Wholesalers, manufacturers, 25c (coin). W-King, 564 Delaware, Buffalo, N. Y.

OPEN A Hollywood or Los Angeles branch office. Business or personal mail. $1.00 monthly. Personal representation if desired. Dependable. Standard Office Service, 2582 West Pico Street, Los Angeles.

CHICAGO! Business-personal mail address, representation, forwarding; $1.00 month. Established 1919. General Business Service, 56 West Washington.

DELAWARE Charters: Complete incorporating and organizing service $35. Submitted forms. Chas. G. Guyer, Inc., Wilmington, Delaware.

ALL International legal matters. Lic. Victores Prieto, Mexican Attorney at Law, P. O. Box 122 M. Juarez, Mexico.

RUBBER STAMPS AND OFFICE SUPPLIES

CUSHION Mounted, one-two lines 25c, three 35c. Signatures $1.50. Stamp Works, 814 Bradley, Peoria, Ill.

NAME 15c, 2 Lines 20c. Rubber Stamps, 676, Hastings, Nebr.

SPECIAL! 3 Lines 25c. Knob handle. Owl, 6452 Kenwood, Chicago.

2 LINES 25c, 3 Lines 35c. Stamp Works, Centerport, N. Y.

METAL Pocket case self-inking name, address stamp 60c. Fehlberg, Lacrosse, Wis.

2 LINES 25c, 3 Lines 35c. Stamprite, FP43, Springfield, Mass.

NAME, Address, 2 lines 25c; 3 lines 35c. Stamp Works, Auburn, Nebr.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

PRINT Your circulars, bulletins, etc., in attractive colors with the Vari-Color duplicator, $27.50 complete. Single color duplicators, $14.50 and up. Illuminoscopes (great aid for preparing stencils), $3.95. Vari-Color Duplicator Co., Ottumwa, Iowa.

PRINT-O-PRESS, World's lowest priced rotary duplicator. See advertisement page 44A.

EFFICIENT Stencil printers 30c to $2.10. Western Publishers, Minneapolis, Minn.

REBUILT Standard size and new portable typewriters at bargain prices. Write for prices. Hoyt's Store, Sac City, Iowa.

TYPEWRITERS, Duplicators, multigraphs. Write for free list office machine bargains. Save half. Pruitt, 518 Pruitt Bldg., Chicago.

INCREASE Business. "Excellograph" rotary stencil, clay and film duplicators $3.85 to $37.50. Prints anything. Typewritten, penned, drawn, traced. Colors. Folder free. Pittsburgh Typewriter Supply, Suite 518, Pittsburgh, Pa.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

SUCCESS! Prestige! Distinctive stationery! Samples! Write, Hall's Printing, Dalton, Massachusetts.

TWO Color printing! Letterheads, envelopes, 100 each $1.25. Academy Press, Gentry, Arkansas.

1000 6x9 CIRCULARS, $3.00; 5000, $8.50; 5000 Envelope slips, $3.90 prepaid. Stationery folders, cards, low prices. Samples. Goodprint, Harrisonburg, Va.

100 ENVELOPES 35c, 500—$1.25. Ranneger, Box 134, Pittsburg, Kansas.

LABEL Value headquarters. Samples free. Labelers, 6618D Quimby, Cleveland, Ohio.

500—$1.25; LETTERHEADS, Envelopes, statements, cards. Sullivan Press, Waco, Texas.

3 ON Checks, 500, $3.50. Bound. All printing reasonable. Samples. Knox Printing, Hoopeston, Illinois.

BUSINESS Cards printed, 70 cents 1000; $3.00, 5000. McBride Printery, 646 McBride Ave., Los Angeles, Calif.

500 ENVELOPES And 500 whitebond letterheads $3.50. Webpress, Farmland, Ind.

250 MIMEOGRAPHED Letters and letterheads $1.75. 500—$2.40; 1000—$3.25. Samples free. Marion Mimeographing Service, 306 South Wabash, Chicago.

1000 ENAMELED Blotters, 3¼x6¼ $4.00. 500 letterheads or envelopes, $1.60. 5000 5½x8½ circulars, $6.50. APress, Box 103, Station W, Brooklyn, N. Y.

125 LETTERHEADS, 125 Envelopes, both $1.00; 500 business cards $1.00; 1000—$1.50. Le Blanc, Box 564, Mt. Vernon, N. Y.

50 SHEETS, 25 Envelopes 25c. 100 name cards 25c. 250 business cards 50c. 25 Christmas folders 50c. Guaranteed. Western Press, North Topeka, Kansas.

250 BOND Letterheads or envelopes $1.00. Woods Press, Bedford, Penna.

5000—6¾ ENVELOPES $8.00. 5000—6x9 Circulars (300 words or less) $7.45. Cash. Postpaid. Hustler, Advance, Ind.

1000 LETTERHEADS, Envelopes, statements or circulars, $2.50 postpaid. Jennings-Pohle Press, Honesdale, Pa.

GOOD Printing. Reasonable. Samples. Harmon Company, 318 South Tenth, Philadelphia, Pennsylvania.

2,000 BUSINESS Cards $2.50. Wilson's Printery, 323 W. 17th, Anderson, Indiana.

GUMMED Labels. All kinds; write, samples. JBSCo., Box 93, Holyoke, Mass.

200 NAME Address stickers 10c postpaid. Superior, P5442 Leland, Chicago.

500 GUMMED Stitckers, ½x2½, 4 lines, 30c. Catalog, 10c. Lambing, 6457P Eggleston, Chicago.

LETTERHEADS, Envelopes, cards, 250 each, $2.50 postpaid. Denney Press, 545 E. Pike, Martinsville, Indiana.

$1.00 FOR 500 Cards, 250 letterheads or 250 envelopes. Lacroix Printery, New Bedford, Mass.

5000 8½x11 LETTERHEADS $8.45, Envelopes $7.45. Midwest Printing, Northfield, Minn.

PRINTING? Lowest prices, samples free. Churchill, 704, Montgomery, Syracuse, N. Y.

PRINTING Bargains—100 8½x11 bond letterheads, 100 envelopes, both $1.00. 250 $1.98. 21 Christmas cards, your name, $1.00. Agents sample 10c. Evans Print, 44 North Tenth, Reading, Pa.

2000 BUSINESS Cards $1.50. Charles Specialty Co., 12-BJ, Norwood, Ohio.

250 ENVELOPES $1; 250 Letterheads $1. Sphinx Printery, Centralia, Illinois.

PRINT Your own. Bargains, presses, type. List 3c. Exchange D-14, 22 Orient, Meriden, Conn.

ENGRAVURE Printing. Lowest possible prices. Samples free. Sunko, Mohawk, N. Y.

$1.00 PRINTING. 1000 Cards, letterheads, etc. United Printing,Pottstown, Pa.

GOOD, Inexpensive printing. Send for catalog. Springer Printery, Miami, Oklahoma.

5000 3¼x6 CIRCULARS $3.25; 250 noteheads, 100 envelopes $1.00. Abbott Press, Oswego, Kansas.

PERSONAL Printed stationery. 100 sheets and 100 envelopes $1.00. 100 name cards 50 cents. Frank O. Wrob, 3974 E. 66 Str., Cleveland, Ohio.

1000 BUSINESS Cards, card case, $1.50. Miller, Printer, Ambler, Pa.

BETTER Grade printing, reasonable priced. Free samples. Economic Press, Leonia, N. J.

CUTS 2x3, $1.10, from drawings and photos. Joe Rek, 118 Gazette Ave., Lexington, Ky.

QUALITY Printing at lowest prices. Samples. A-B Printing, 844 N. Marshall, Philadelphia.

PRINTING OUTFITS AND SUPPLIES

HAND Press, type and complete printers' supplies. Advise equipment you need and we quote prices; or send stamp for catalog. P. Peiffer, 1 B; 6 Columbia St., Newark, N. J.

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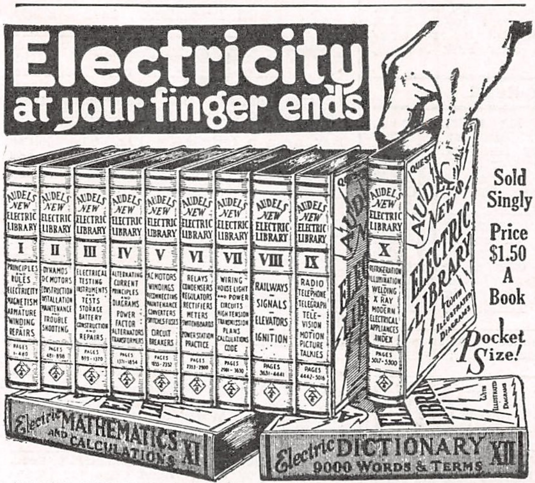
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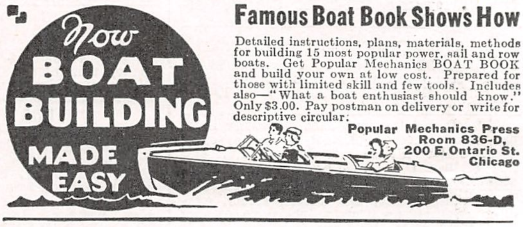
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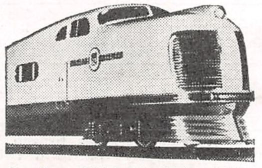

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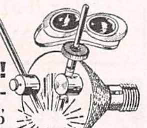

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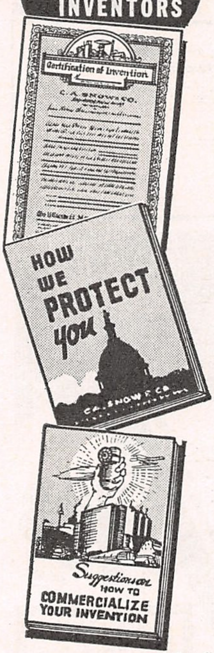
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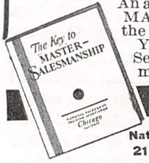

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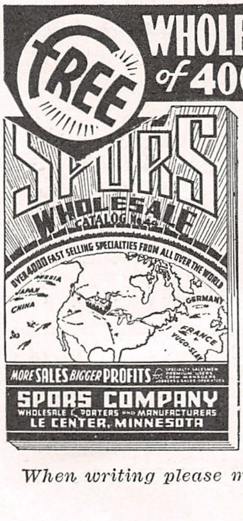
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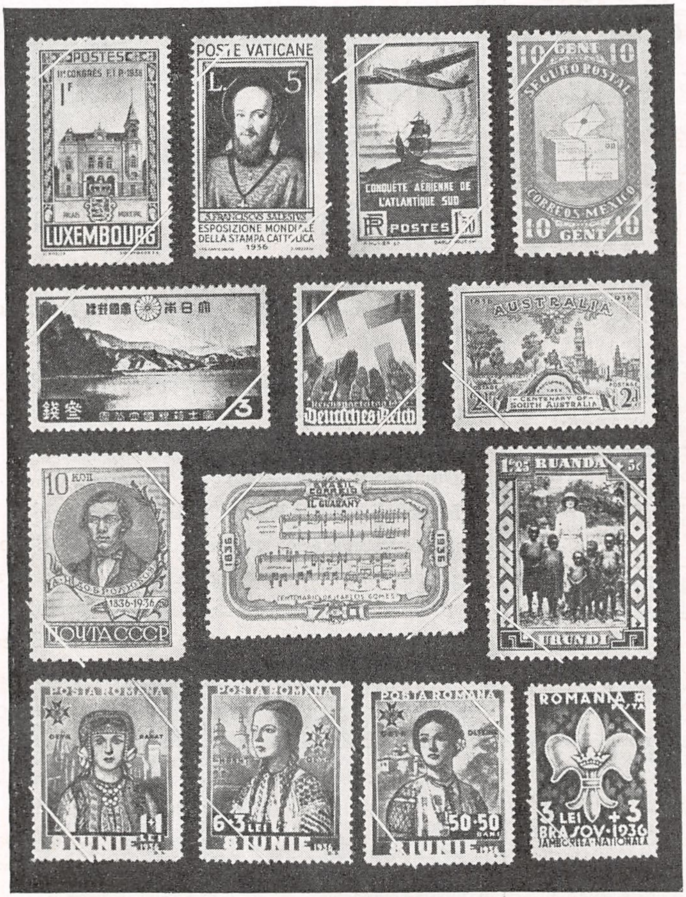
STAMPS and COLLECTING

(Continued from page 50A)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Some recent stamp issues of various foreign countries which are described in the accompanying notes

reason for its appearance. Although each stamp alone constitutes an imperforate variety of a previously issued stamp, the cataloguers class them as separate issues and give them new catalogue numbers.

A three-cent, violet stamp was placed on sale, June 15, at Little Rock, Ark., to mark the 100th anniversary of Arkansas. This is the same size as the Texas stamp. The Arkansas stamp was followed, on July 14, by a three-cent, violet map stamp to honor the settlement of Oregon territory. On August 26, the department placed on sale another three-cent, violet stamp to honor Susan B. Anthony, foremost proponent of woman suffrage. This stamp is of regular size and bears a portrait of Miss Anthony.

Recent Stamp Issues

Luxemburg has issued a series of six values in connection with the eleventh International Philatelic congress. These stamps are printed by rotogravure and show the city hall at Luxemburg. A Vatican City series has been issued to commemorate the Catholic Press conference in Rome. The eight values show four designs, two being portraits of Saint John of Bosco and Saint Francis of Sales. The other designs are allegorical arrangements.

France has a striking airmail stamp issued in honor of the conquest of the South Atlantic ocean by air. This shows a monoplane passing high above a caravel such as was used by the first Europeans who crossed that ocean. Mexico has a set of three stamps to advertise the safety of the postal system. Japan has a series of four values to show the beauties of the Fuji-Hakone National Park. Two values comprise a German set issued in connection with the recent Nazi party meeting at Nuremburg. These show hands saluting a mighty swastika. Three stamps have been issued by Australia to commemorate the centenary of South Australia. Russia honors the 100th anniversary of A. N. Dobrolinbov, writer and critic. One of the most interesting sets is that which Brazil has issued to honor the centenary of Carlos Gomes, the composer. New stamps of Congo and of Belgian East Africa show a portrait of Queen Astrid among a group of black children. Roumania has two new sets, one of which shows provincial types of young people while the other honors a national Jamboree of Boy Scouts.

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- Day
- Dean(e)
- Decker(t)
- Delan(e)y
- Dennis
- Den(n)ison
- Dent
- Derby—Darby
- Dewey
- DeWitt
- DeWolf(e)
- Dexter
- Dick(e)
- Dickens
- Dickinson
- Dickson
- Dill—Dell
- Dinsmore
- Dixon
- Doan(e)
- Dodd
- Dodge
- Dodson
- Doggett
- Dole
- Donaldson
- Dorr—Dore
- Dotson
- Do(u)gherty
  - Daugherty
- Douglas(s)
- Dow
- Dowd—Doud
- Downing
- Doyle
- Drake
- Draper
- Drummond
- Drury—Drewry
- Dryden
- Dudley
- Duke(s)
- Duncan
- Dunham
- Dunn(e)
- Durfee
- Dutton
- Duval(l)
- Dye
- Dyer

- Eames
- Eastman
- Eaton
- Eddy
- Edgerton
- Edmonds
  - Edmunds
- Edmon(d)son
- Edwards
- Eldridge
  - Eldredge
- Elliot(t)
- Ellis
- Ellsworth
- Elmer
- Elmore
- Ely
- Emerson
- Emery
- Emmett
- Endicott
- Erskine
- Estes
- Eubank
- Evans
- Everett
  - Everitt
- Ewing

- Fairchild
- Farrell
  - Faulkner
- Fell
- Fenn
- Fenton
- Ferguson
- Ferrell
- Ferris—Farris
- Field
- Finney
- Fish
- Fisher
- Fisk(e)
- Fitzgerald
- Fitzpatrick
- Flagg
- Flem(m)ing
- Fletcher
- Flint
- Flood
- Flower(s)
- Floyd
- Flynn—Flinn
- Foley
- Folsom
- Foote
- Forbes
- Ford
- For(e)man
- Forrest
- Forsyth(e)
- Fort(e)
- Foster
- Fowler
- Fox
- Francis
- Frank(e)
- Franklin
- Fraz(i)er
  - Fraser
- Fred(e)rick
- Freeman
- French
- Fritz—Fritts
- Frost
- Fuller
- Fulton

- Gage
- Galbraith
  - Galbreath
- Gale
- Galloway
- Gallup—Gallop
- Gamble
- Gard(i)ner
- Garfield
- Garland
- Garrett
- Gary
- Gates
- Ga(u)lt
- Gay
- George
- Gerard
  - Garard
- Gerhard(t)
  - Gerhart
- Gerry
- Gibbon(s)
- Gibbs
- Gibson
- Gifford
- Gilbert
- Gilchrist
- Giles
- Gillette
  - Gillet(t)
- Gill(i)am
- Gilli(e)s
- Gil(l)man
- Gilmore
  - Gilmour
  - Gilmer
- Glasgow
- Gleason
  - Gleeson
- Glen(n)
- Glover
- Goddard
- Godfrey
- Goff
- Good(e)
- Goodman
- Goodrich
- Goodwin
- Gordon
- Gorham
- Gough
- Gould
- Graham
- Grant
- Graves
- Gray—Grey
- Green(e)
- Greenwood
- Greer—Grier
- Griffin
- Griffith
- Grinnell
- Griswold
- Grover
- Grove(s)
- Grubb(s)
- Gurney
- Guthrie
- Gwynn—Gwinn
- Hacker
- Haddock
- Hadley
- Hager
- Haggard
- Haines
  - Haynes
- Hale
- Haley
- Hall
- Hallowell
- Halsey
- Halste(a)d
- Hamilton
- Hamlin
- Hammond
- Hampton
- Hancock
- Hand
- Han(d)ley
- Hank(e)s
- Hardin
  - Harden
- Harding
- Hardy—Hardie
- Haring
- Harmon
  - Harman
- Harper
- Harrington
- Harris
- Harrison
- Hart
- Hartley
- Harvey
- Harwood
- Haskell
- Haskins
- Hastings
- Hatfield
- Hathaway
- Hawkins
- Hawk(s)
- Hawley
- Hayden
- Hayes—Hay(s)
- Hayward
- Haz(z)ard
- Heal(e)y
- Heath
- Hedge(s)
- Henderson
- Henry
- Herbert
- Herman
- Herrick
- Her(r)ing
- Herrington
- Her(r)on
- Hersey
- Hess(e)
- Hewitt
  - Hewett
- Hibbard
- Hibbert
- Hickman
- Hicks
- Higgins
- Hill
- Hilton
- Hin(c)kley
- Hind(s)
- Hine(s)—Hynes
- Hinman
- Hitchcock
- Hite—Hight
- Hoag—Hoge
- Hoagland
- Hoar(e)
- Hobson
- Hodge(s)
- Hodgson
- Hoffman
- Hogg
- Holbrook
- Holcomb(e)
- Holland
- Hollingsworth
- Holloway
- Holt
- Hooker
- Hooper
- Hopkins
- Hopper
- Hopson
- Horn(e)
- Horton
- Hoskin(s)
- Houghton
- H(o)uston
- Howard
- Howe(s)
- Howland
- Hubbard
- Hubbell
- Hudson
- Hughes
- Hulbert
  - Hurlbu(r)t
- Hull
- Humphrey(s)
- Hunt
- Hunter
- Huntington
- Hurd—Heard
- Hurst
- Hutchin(g)s
- Hutchi(n)son
- Hutton
- Hyde
- Ingersoll
- Ingra(ha)m
- Irvin(e)
- Irwin
- Jack(s)
- Jackson
- Ja(c)ques
- James
- Janes
- Jarvis
- Jeffrey
  - Jeffery
- Jeffries
- Jenkins
- Jennings
- Jewell
- Jewett
- John(s)
- Johnson
- Jones
- Jordan
- Joy
- Joyce
- Judd
- Julian
- Kane—Kain(e)
- Kearney
- Keeler
- Keen(e)
  - Kean(e)
- Keith
- Keller—Kellar
- Kell(e)y
- Kellogg
- Kemp
- Kendall
- Kendrick
- Kennard
- Kennedy
- Kenner
- Kenn(e)y
  - Kinney
- Kent
- Kern(s)
- Kerr
- Ketcham
  - Ketchum
- Key(e)s
- Kidder
- Kimball
  - Kimble
- King
- Kingsbury
- Kirby—Kerby
- Kirk
- Kirkland
- Kirkpatrick
- Knapp
- Knight
- Knott
- Knowles
- Knowlton
- Knox
- Kolb
- Kyle
- Ladd
- Lake
- Lamb
- Lambert
- Lamont
- Lamson
- Lancaster
- Landis
  - Landes
- Landon
  - Langdon
- Lane
- Latham
- Lathrop
  - Lothrop
- Latimer
- Law
- Lawrence
- Lawson
- Lawton
- Leach—Leech
- Le(a)vitt
- Lee
- Lefe(b)vre
- Leland
- Len(n)ox
- Leonard
- Leslie—Lesley
- Lewis
- Lill(e)y—Lillie
- Lincoln
- Lind(e)
  - Lynd(e)
- Lindsay
  - Lindsey
- Linton
- Lippincott
- Littell
- Little
- Livingston
- Llewellyn
- Lloyd
- Lock(e)
- Locket(t)
- Lockhart
- Lockwood
- Logan
- Long
- Loomis
- Lord
- Love
- Lovejoy
- Lovett
- Low(e)
- Lowell
- Low(e)ry
- Lucas
- Luce
- Lucy
- Ludlow
- Luther
- Lyman
- Lynch
- Lynn(e)—Linn
- Lyon
- Macaulay
  - Macauley
- M(a)cDonald
- M(a)cDougall
- M(a)cFarland
- M(a)cFarlane
- M(a)cGregor
- M(a)cKay
- M(a)cKenzie
- M(a)cLean
- M(a)cLeod
- M(a)cMahon
- M(a)cMurray
- M(a)cNab(b)
- M(a)cPherson
- M(a)cRae
- Magill
- Malcolm
- Mann
- Manning
- Maples
- Mar(a)ble
- Markham
- Mark(s)
- Marley
- Marsh
- Marshall
- Marston
- Martin
- Marvin
- Mason
- Masters
- Masterson
- Mather
- Mat(t)hews
- Maxwell
- May
- Mayer
- Mayhew
- Mayo
- McAdam(s)
- McAllister
- McCall
- McCart(h)y
- McClain
- McClure
- McCormack
  - McCormick
- McCune
  - McEwen
  - McEwan
- McDaniel(s)
- McDowell
- McElroy
- McGee—Magee
- McGill
- McGinnis
- McGowan
  - McGowen
- McGuire
  - Maguire
- McIntosh
- McIntyre
  - McIntire
- McKean
- McKee
- McKinley
- McKinney
  - McKenney
- McLain
  - McLane
- McLaughlin
- McMaster(s)
- McNamara
- McNeil(l)
  - McNeal
- Mead(e)
- Mellen
  - Mellon
  - Mellin
- Melvin
- Mercer
- Mercier
- Meredith
- Merriam
- Merrill
- Merriman
- Merritt
- Messinger
  - Messenger
- Metcalf(e)
- Meyer(s)
- Michel(l)
- Middleton
- Miles—Myles
- Millard
- Miller
- Milligan
- Milliken
- Mills
- Miner
  - Minor
- Mitchel(l)
- Moffat(t)
  - Moffitt
  - Moffett
- Monroe
  - Munro(e)
- Montague
- Montgomery
- Moody
- Mooney
- Moore—More
- Moran
- Morehouse
- Morey
- Morgan
- Morley
- Morrell
  - Morrill
- Morris
- Morrison
- Morrow
- Morse
- Mortimer
- Morton
- Mos(e)ley
- Mott
- Moulton
- Mowr(e)y
- Munson
  - Monson
- Murray
- Myer(s)
- Nagel—Nagle
- Nance
- Nash
- Neal(e)
  - Neil(l)
- Nelson
- Nesbit
- Neville
- Nevins
- Newberry
- Newcomb
- Newell
- Newland
- Newman
- Newton
- Nicholas
- Nichol(l)s
- Nicholson
- Niles
- Nisbet
- Noble
- Nolan
- Norris
- North
- Northrup
  - Northrop
- Norton
- Nott
- Noyes
- Odell
- Ogden
- Ogilvie
- Oglesby
- Olin
- Oliver
- Olmste(a)d
- O'Neil(l)
- Osborn(e)
- Overton
- Owen(s)
- Pace
- Page—Paige
- Painter
- Palmer
- Parker
- Parkhurst
- Parkinson
- Park(s)
  - Parke(s)
- Parnell
- Parsons
- Partridge
- Pate
- Pat(t)erson
- Pat(t)on
  - Patten
- Paul
- Payne
  - Pain(e)
- Paxton
- Peabody
- Peacock
- Peak(e)—Peek
- Pearson
  - Pierson
- Pease
- Peck
- Peckham
- Peel—Peal
- Penn
- Pennington
- Percival
- Perkins
- Perrin(e)
- Perry
- Peters
- Peterson
  - Petersen
- Pet(t)it
- Petty
- Phelps
- Phillips
- Phinney
- Pickens
- Pickering
- Pierce
  - Pearce
- Pike
- Pillsbury
- Pinkerton
- Piper
- Pit(t)man
- Pitt(s)
- Place
- Plant
- Platt
- Plummer
- Plunkett
- Poe
- Poindexter
- Polan(d)
- Polk
- Pollard
- Pollock
- Pomeroy
- Pond
- Pool(e)
- Poor(e)
- Pope
- Porter
- Posey
- Post
- Potter
- Potts
- Powell
- Powers
- Pratt
- Prentice
  - Prentiss
- Prescott
- Preston
- Price
- Prince
- Prindle
- Pringle
- Pritchard
- Pryor—Prior
- Purdy
- Putnam
- Quackenbush
- Quarles
- Quick
- Quinn
- Radcliff(e)
  - Ratcliff(e)
- Rainey
- Ralston
- Ramsdell
- Ramsey
  - Ramsay
- Rand
- Randall
- Randolph
- Rankin
- Ranney
- Ransom
  - Ranson
- Rathbun
- Rawlin(g)s
- Rawson
- Ray
- Raymond
- Reading
- Red(d)ing
- Redfield
- Reed
  - Reid
  - Read
- Rees(e)
  - Reece
- Reeve(s)
  - Reaves
- Reynolds
- Rhea
- Rice
- Richards
- Richardson
- Ricker
- Riddle
  - Riddell
- Rider—Ryder
- Ridg(e)way
- Riggs
- Riley
- Ripley
- Ri(t)chie
  - Ri(t)chey
- Rittenhouse
- Ritter
- Rivers
- Roane
- Robbins
- Roberts
- Robertson
- Robin(s)
- Robinson
- Rockwell
- Rockwood
- Rodman
- Roe
- Ro(d)gers
- Rollins
- Rooks—Rook(e)
- Rose
- Ross
- Rosser
- Rossiter
- Round(s)
- Rowan
- Rowe
- Rowell
- Rowland
- Rowley
- Ruggles
- Rush
- Russel(l)
- Rust
- Rutherford
- Rutter
- Ryan
- Ryerson
- Sabin
- Sackett
- Sage
- St. John
- Salisbury
- Salter
- Sam(p)son
- Sanborn
- Sanderson
- Sanford
- Sargent
- Sa(u)nders
- Savage
- Sawyer
- Sayre—Sayer
- Scarb(o)rough
- Schaef(f)er
  - Schaf(f)er
- Schen(c)k
- Schermerhorn
- Schneider
- Schultz
- Schumacher
- Schuyler
- Scott
- Scovil(l)e
- Sears
- Sebastian
- Seel(e)y
- Selden—Seldon
- Sellers
- Semple
- Seward
- Sewell—Sewall
- Sexton
  - Saxton
- Seymour
- S haf(f)er
- Shannon
- Sharp(e)
- Shaw
- Shay
- Shea
- She(a)rer
- Sheldon
- Shelton
- Shepherd
  - Shep(p)ard
- Sheridan
- Sherman
- Shield(s)
- Shipley
- Shirley
- Shoemaker
- Sim(m)onds
- Sim(m)ons
  - Symons
- Sims—Simms
- Simpson
- Sinclair
- Singleton
- Sinnott
- Skinner
- Slack
- Slade
- Slater
- Slocum
- Small
- Smart
- Smith
- Snodgrass
- Snow
- Snowden
- Snyder
  - Snider
- Som(m)erville
- Spafford
  - Spofford
- Spangler
- Sparks
- Spa(u)lding
- Spear
- Speed
- Spence
- Spencer
- Spengler
- Spicer
- Spooner
- Sprague
- Springer
- Squire(s)
- Staat(s)
- Stafford
- Standish
- Stanford
- Stanley
- Stanton
- Staples
- Stapleton
- Star(c)k
- Starkey
- Starr
- Stauffer
  - Stouffer
- Stearn(s)
- Stebbins
- Steel(e)
- Steen
- Sterling
  - Stirling
- Stetson
- Stevens
  - Stephens
- Stevenson
  - Stephenson
- Stewart
  - Stuart
- Stickney
- Stiles—Styles
- Stillman
- Stil(l)well
- Stim(p)son
- Stinson
- Stockton
- Stoddard
- Stokes
- Stone
- Storer
- Stor(e)y
- Storm
- Stout
- Stover
- Stowell
- Strange
- Stratton
- Street
- Streeter
- Strickland
- Strong
- Stroud
- Stryker
  - Stricker
- Stubbs
- Stump(e)
- Sturges
  - Sturgis
- Sullivan
- Sumner
- Sutcliffe
- Sutherland
- Sutton
- Swain—Swayne
- Sweet
- Swett
- Swift
- Sylvester
- Taft
- Taggart
- Talbot(t)
- Taliaferro
- Talley
- Tal(l)madge
  - Talmage
- Tal(l)man
- Tanner
- Tate—Tait
- Taylor
- Teague
- Temple
- Tenn(e)y
- Terrell
  - Terrill
- Terry
- Tha(t)cher
- Thayer
- Thomas
- Thom(p)son
- Thorn(e)
- Thornton
- Thorp(e)
- Thurman
- Thurston
- Tibbet(t)s
  - Tibbit(t)s
- Tiffany
- Tilley
- Tindall
- Tinker
- Todd
- Tomlinson
- Tompkins
- Torrey
- Tower(s)
- Towne
- Townley
- Townsend
- Trac(e)y
- Trask
- Traver(s)
- Travis
- Tre(a)dwell
- Tripp
- Trowbridge
- Trumbull
- Tubbs
- Tucker
- Tudor
- Tufts
- Turnbull
- Turner
- Turney
- Tuttle
  - Tuthill
- Tyler
- Tyrrell
- Tyson
- Underhill
- Underwood
- Upham
- Upton
- Usher
- Vail
- Van Buren
- Van D(e)usen
- Van Dyke
  - Van Dyck
- Van Horn(e)
- Van Meter
- Vaugh(a)n
- Vernon
- Vinton
- Waddell
- Wade
- Wadsworth
- Wagner
  - Wag(g)oner
  - Wagener
- Waite
- Wakefield
- Waldo
- Waldron
- Wales
- Walker
- Wall
- Wallace
- Waller
- Wallis
- Walsh
- Walter(s)
- Walton
- Ward
- Warden
- Ware
- Warfield
- Waring
- Warner
- Warren
- Warwick
- Washburn(e)
- Washington
- Waterhouse
- Waterman
- Watson
- Wat(t)ers
- Watt(s)
- Wayne
- Weaver
- Webb
- Web(b)er
- Webster
- Weeks
- Weir
- Welch—Welsh
- Wellman
- Wells
- Wendel(l)
- Wentworth
- Wesley
- West
- Weston
- Wetmore
- Whaley
- Wharton
- Wheaton
- Wheeler
- Whipple
- Whitcomb
- White
- Whit(e)ford
- Whitehead
- Whitfield
- Whiting
- Whitlock
- Whitman
- Whitmer
- Whitney
- Whit(t)aker
- Whit(te)more
- Whittlesey
- Wickham
- Wilbur—Wilber
- Wilder
- Wiley—Wylie
- Wilk(e)s
- Wilkins
- Wilkinson
- Willard
- Wil(l)cox
- Willett
- Will(e)y
- Williams
- Williamson
- Willis
- Willoughby
- Wills
- Wilson
- Winchester
- Windsor
- Wing
- Winn(e)
- Winslow
- Winston
- Winter
- Wise
- Wiseman
- Withers
- Witherspoon
- Witt
- Witter
- Wolcott
- Wolf(e)—Wolff
- Woodbury
- Woodcock
- Woodman
- Woodruff
- Wood(s)
- Woodward
- Woodworth
- Wool(l)ey
- Woolsey
- Worden
- Worthington
- Wray
- Wren(n)
- Wright
- Wyatt
- Wyman
- Wynn(e)
- Yale
- Yates
- Yeoman(s)
- York
- Young
- Youngman
- Zimmerman(n)

A Coat of Arms for any family listed here can be accurately and expertly hand painted in vivid colors by our heraldic artists for only $9.50. Allow six days for completion.

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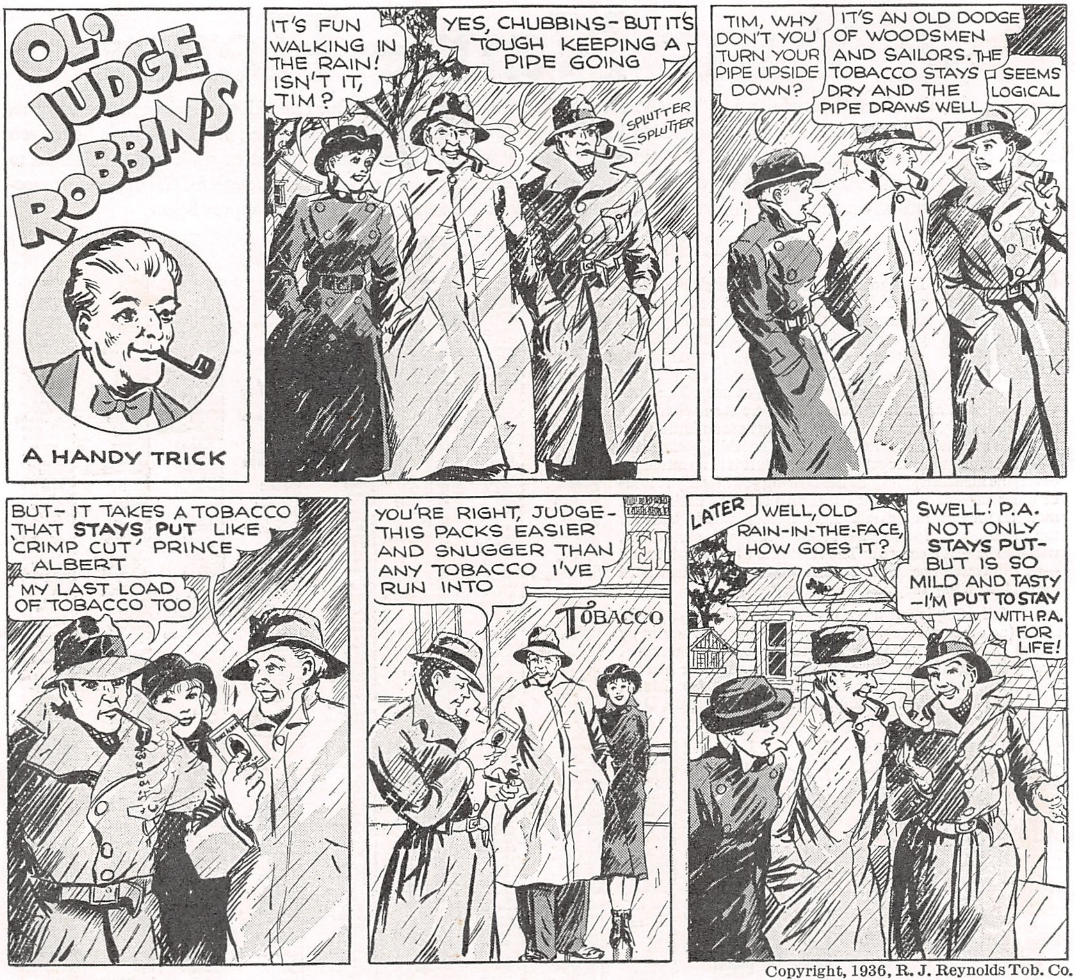
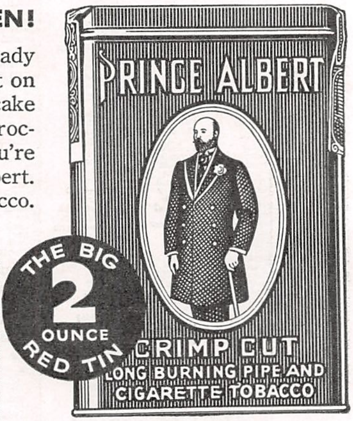

OL' JUDGE ROBBINS
A HANDY TRICK
IT'S FUN WALKING IN THE RAIN! ISN'T IT, TIM?
YES, CHUBBINS - BUT IT'S TOUGH KEEPING A PIPE GOING
SPLUTTER SPLUTTER
TIM, WHY DON'T YOU TURN YOUR PIPE UPSIDE DOWN?
IT'S AN OLD DODGE OF WOODSMEN AND SAILORS. THE TOBACCO STAYS DRY AND THE PIPE DRAWS WELL
SEEMS LOGICAL
BUT- IT TAKES A TOBACCO THAT STAYS PUT LIKE 'CRIMP CUT' PRINCE ALBERT
MY LAST LOAD OF TOBACCO TOO
YOU'RE RIGHT, JUDGE- THIS PACKS EASIER AND SNUGGER THAN ANY TOBACCO I'VE RUN INTO
TOBACCO
LATER
WELL, OLD RAIN-IN-THE-FACE, HOW GOES IT?
SWELL! P.A. NOT ONLY STAYS PUT- BUT IS SO MILD AND TASTY -I'M PUT TO STAY WITH P.A. FOR LIFE!

Copyright, 1936, R. J. Reynolds Tob. Co.

P. A. IS MIGHTY FRIENDLY SMOKIN', MEN!

Yes, sir, Prince Albert is a real delight to steady pipe smokers. Being "crimp cut," you can count on P.A. to pack easily, burn cool and sweet, and cake up nicely. And thanks to our special "no-bite" process, Prince Albert *does not bite the tongue!* You're in good company when you smoke Prince Albert. It's the world's largest-selling smoking tobacco. And it's swell "makin's" too.


PRINCE ALBERT
THE BIG 2 OUNCE RED TIN
CRIMP CUT
LONG BURNING PIPE AND CIGARETTE TOBACCO

PRINCE ALBERT MONEY-BACK GUARANTEE

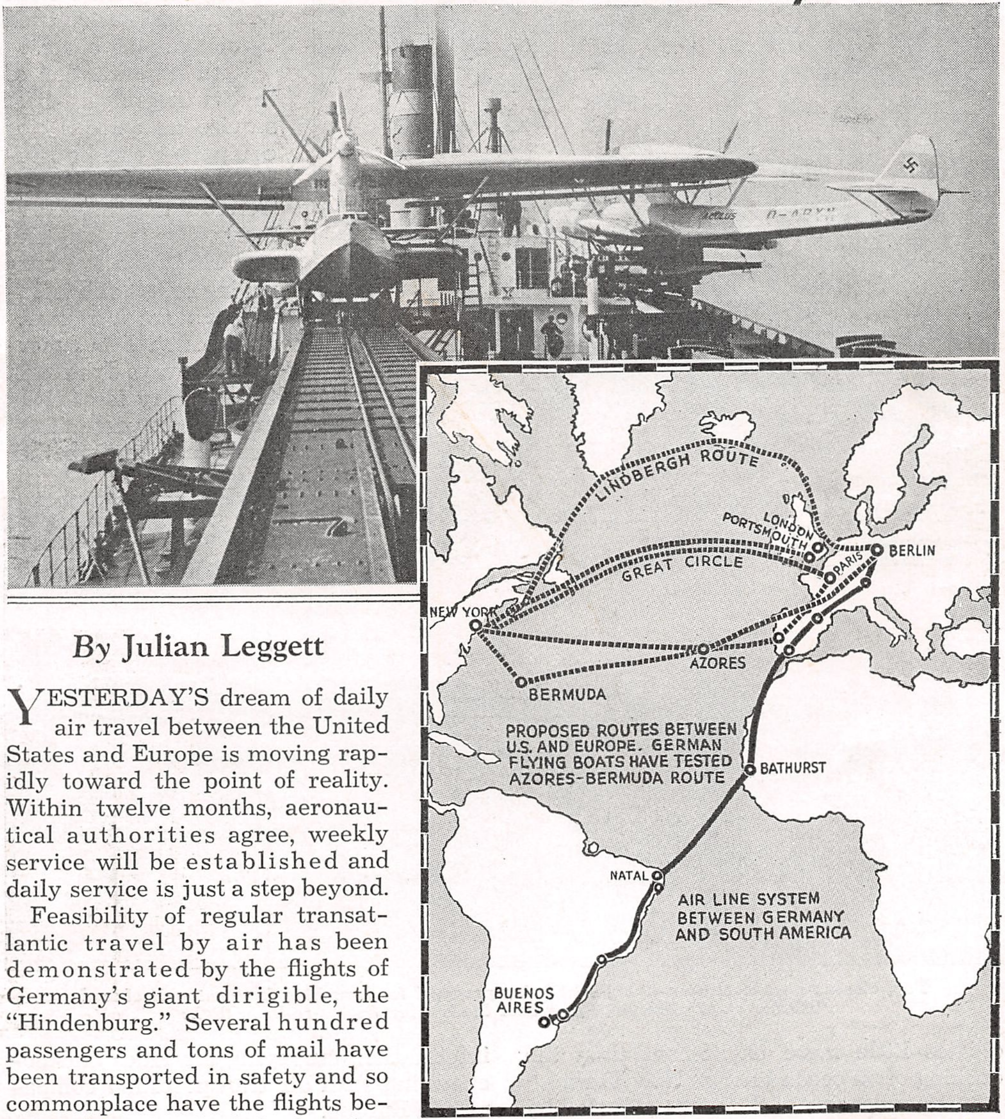
Smoke 20 fragrant pipefuls of Prince Albert. If you don't find it the mellowest, tastiest pipe tobacco you ever smoked, return the pocket tin with the rest of the tobacco in it to us at any time within a month from this date, and we will refund full purchase price, plus postage. (*Signed*)
R. J. Reynolds Tobacco Co., Winston-Salem, N. C.

PRINCE ALBERT **THE NATIONAL JOY SMOKE!**

50 pipefuls of fragrant tobacco in every 2-oz. tin of Prince Albert

Popular Mechanics Magazine
REGISTERED IN U. S. PATENT OFFICE AND CANADA
WRITTEN SO YOU CAN UNDERSTAND IT
Vol. 66 DECEMBER, 1936 No. 6

U.S. to EUROPE by AIR


LINDBERGH ROUTE
LONDON
PORTSMOUTH
BERLIN
PARIS
GREAT CIRCLE
NEW YORK
AZORES
BERMUDA
PROPOSED ROUTES BETWEEN U.S. AND EUROPE. GERMAN FLYING BOATS HAVE TESTED AZORES-BERMUDA ROUTE
BATHURST
NATAL
AIR LINE SYSTEM BETWEEN GERMANY AND SOUTH AMERICA
BUENOS AIRES

Top, flying boat on catapult. Bottom, dotted lines show U. S.-Europe routes. Solid line shows German route to South America

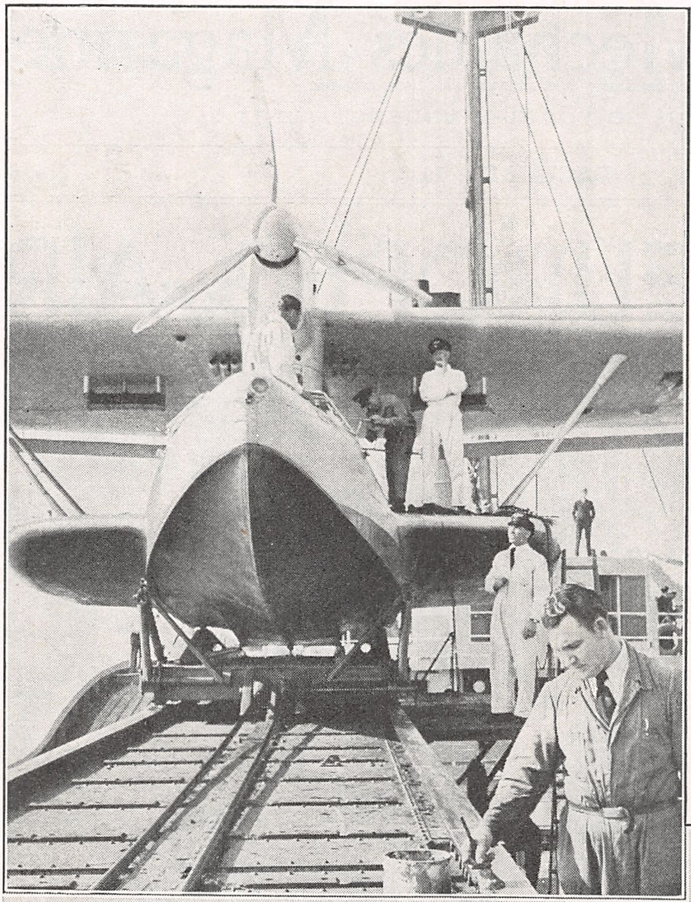
By Julian Leggett

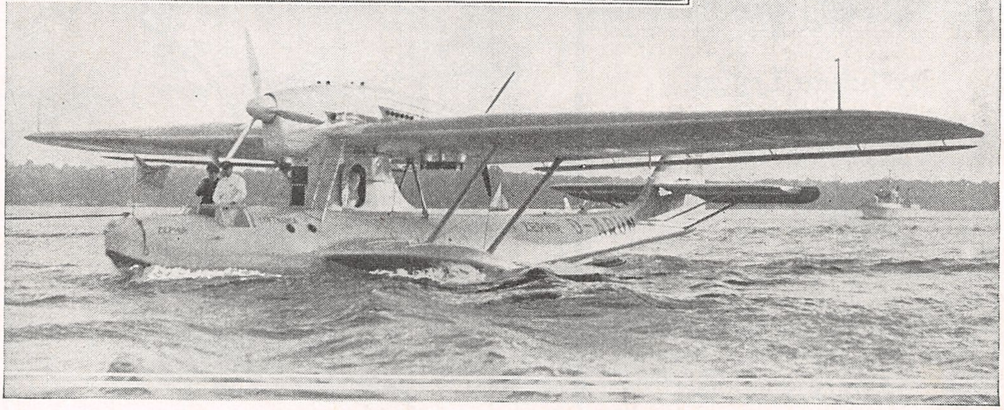
YESTERDAY'S dream of daily air travel between the United States and Europe is moving rapidly toward the point of reality. Within twelve months, aeronautical authorities agree, weekly service will be established and daily service is just a step beyond.

Feasibility of regular transatlantic travel by air has been demonstrated by the flights of Germany's giant dirigible, the "Hindenburg." Several hundred passengers and tons of mail have been transported in safety and so commonplace have the flights become that arrival of the big ship at either of its destinations, Frankfort or Lakehurst, N. J., cess of the dirigible, from a commercial standpoint, has been based on the novelty of the trip rather than on the amount of time saved. The "Hindenburg's" speed is limited to between eighty and ninety miles per hour under favorable conditions, only half that which might be achieved by using flying boats.

With the intention of instituting flying-boat service as quickly as equipment can be provided, companies in the United States, Germany, France, England and Holland are surveying routes and training crews for transatlantic duty. Pan American Airways System in this country is actively engaged in preliminary work, gathering weather information, surveying air lanes and cooperating with air transportation companies in Europe.

While each company recognizes the advantage of being the first to offer weekly or daily service, there is little competitive





Top, closeup view of ten-ton flying boat being prepared for launching from catapult aboard "mother ship." Bottom, flying boat lands after Azores-to-U. S. flight

creates little more excitement than the docking of an ocean liner at New York.

But service faster than that afforded by the "Hindenburg" or any other dirigible is regarded as necessary if air travel to Europe is to be a paying proposition. Sucresearch work being done. All operate under an agreement calling for exchange of information on routes and weather and all apparently realize the necessity for such service to be entirely safe and capable of operating on schedule.

There will be two routes to Europe, one by the great circle course between Newfoundland and Ireland, the other by the Azores. The great circle route has the advantage of being shorter, while the Azores lane offers safety from winter storms and provides a point at which the journey may be interrupted for servicing the ships. Still a third route, by way of Greenland, Iceland and the Orkney islands, is available, but the distance is greater and travel would be almost impossible in winter. The third route was surveyed by Col. Charles A. Lindbergh several years ago.

Germany's Deutsche Lufthansa Airline recently made experimental flights over the Azores route, for the purpose of obtaining weather data and of testing the practicability of launching huge flying boats by catapult from "mother" ships stationed at points on the route. Two ten-ton planes equipped to land on the water were used in the tests, the "Zephyr" and the "Aeolus." Catapulted from the "Schwabenland," a ship equipped especially for hurling the flying boats into the air, the "Zephyr" flew directly from the Azores to the United States, a distance of 2,390 miles in twenty-two hours and fourteen minutes. This was an average speed of 108 miles per hour. The "Aeolus" flew by way of Bermuda, where an overnight stop was made, and covered 2,833 miles in twenty-four hours and nineteen minutes, an average of 116 miles per hour.

While no attempt was made to establish a speed record, these two flights demonstrated how much faster service can be offered by using flying boats.

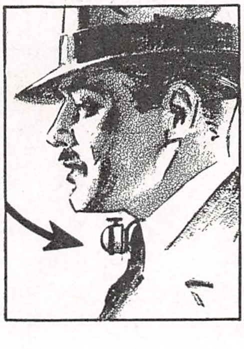
(Continued to page 162A)

School Held in Train Cars Converted for Class Work

Interior of railway coach converted for science classes. Tables and equipment racks replaced regular seats in the car

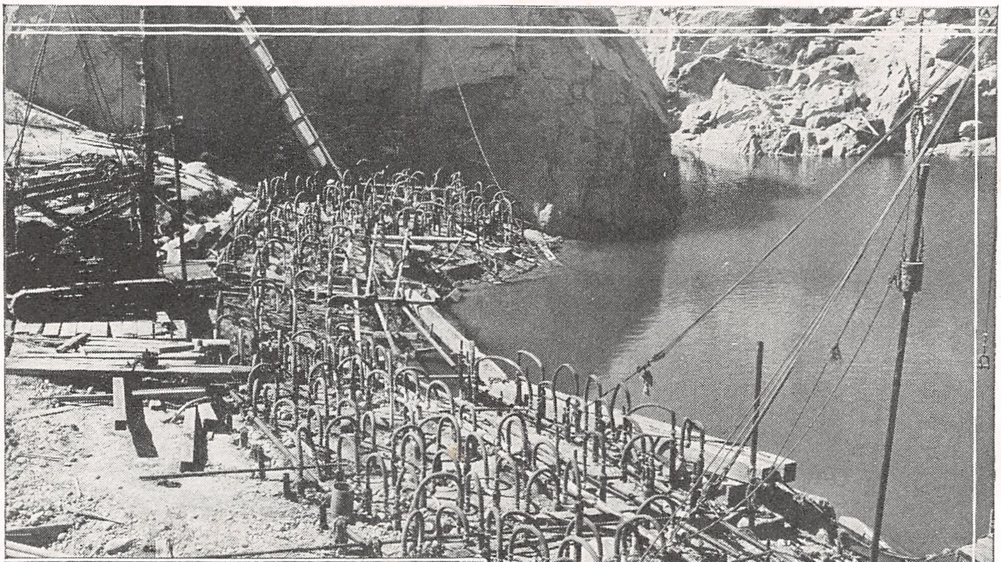
When their school building was wrecked by an earthquake, 1,000 high school pupils at Helena, Mont., began attending classes in eighteen railway coaches loaned by two lines serving the city. The coaches were set on a siding and boardwalks built to connect the cars and to provide a runway from the ground to the platforms. In most of the coaches, the pupils occupy the regular seats, but in some classes they use tables for handling scientific apparatus. The cars are heated by a central plant.

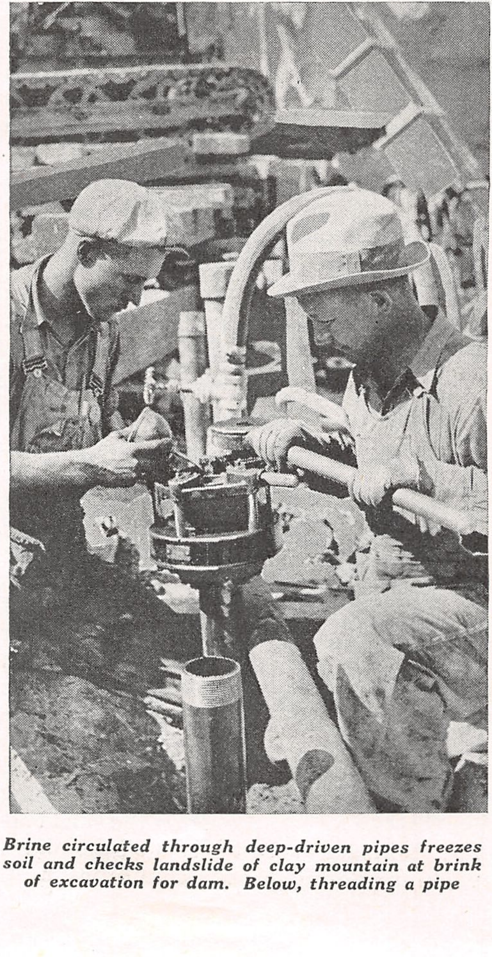
Alarm to Keep Motorist Awake Buzzes When Chin Drops



Dozing at the wheel is a common cause of automobile accidents. To eliminate that cause, an inventor has devised an alarm that rings sharply at the motorist's first nod. It is a small metal gong that is hung from the shirt collar. A trigger at the top sets off the alarm when the dozing driver's chin drops on it.

Stemming a Landslide by Freezing Its Toes





Brine circulated through deep-driven pipes freezes soil and checks landslide of clay mountain at brink of excavation for dam. Below, threading a pipe

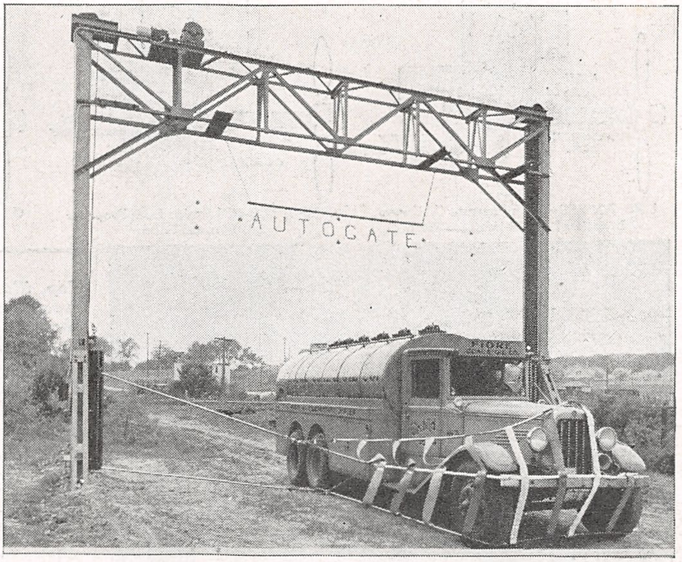
Moving like an irresistible glacier, a mountain of clay crept down upon the excavations for the Grand Coulee dam in Washington, menacing the great construction project. Steam shovels made futile efforts to clear the sliding clay as fast as it advanced. A concrete wall was thrown up hurriedly, but the slide topped it. Then the engineers hit upon the plan of freezing the toes of the landslide. In excavating at the east end of the dam they had encountered a crevasse which had to be cleaned to the bottom to find a rock foundation for the dam. This left a hole 100 feet deep and an acre in area at the top, and above the hole a fan-shaped hill of clay, 200,000 cubic yards of it, which began slipping into the crevasse with high water in the spring. To freeze the foot of the clay slide and turn it into a solid dam of frozen earth, more than 300 three-inch pipes were driven about forty-seven feet deep in a cluster just above the concrete wall, which was then under water. Spaced thirty inches apart, the pipes had nipples at the top and outlets on the sides near the top. Then pipes of one and one-half inch diameter were inserted through the nipples and extended almost to the bottom of the larger pipes, which were connected in series in groups of sixteen by short hose links, and all connected to a common feeder and common return pipe. Finally brine from a refrigerating plant fifty feet up on a rock cliff was pumped into the smaller pipes and allowed to rise through the large pipes and spill into the return channel, thus freezing the earth more than forty feet deep. The refrigerating plant comprises two compressors of eighty-ton capacity.

Air Propeller Drives Speedboat with Motorcycle Engine

With a motive plant borrowed from aeronautics and motorcycling, a tiny power boat skims over the Mississippi at high speed. It is powered by a motorcycle engine mounted high at the stern, driving a small airplane propeller. The little craft is quite economical to operate.

Diminutive speedboat driven by an airplane propeller with a motorcycle engine for power

Crossing Gate Halts Auto or Truck Without Damage

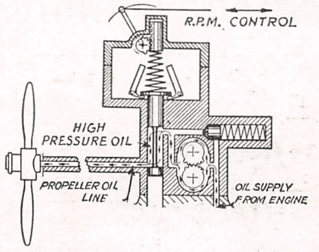


Big truck being halted by crossing gate which "stretches" 100 feet to bring vehicles to gradual stop. Note harness gripping front of truck

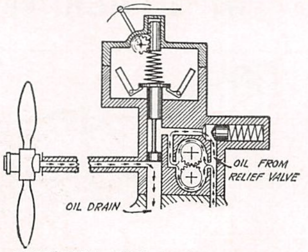
Designed as a means of preventing automotive vehicles from crossing a street intersection or a railroad right of way, an automatic gate is being tested under all traffic conditions. The gate unit consists of a harness made of wire rope, the ends of which are attached to heavy springs operating in oil. As a speeding car or truck strikes the gate, the wire rope and springs gradually bring it to a halt, within the 100-foot extension limit provided, without damage. The wire rope is arranged so that it exerts friction on each front tire, providing powerful braking action. A heavy steel frame anchored on each side of the road and located so that the vehicle must pass between the side supports resists the pull of the largest truck. A warning signal lowers when a train operates a button contact a mile from the crossing or when the traffic lights change at an intersection. A few seconds later the gate lowers across the road. A three-horsepower motor and reduction gearing are employed to raise the gate.

¶In all the seas there are estimated to be 329 million cubic miles of water.

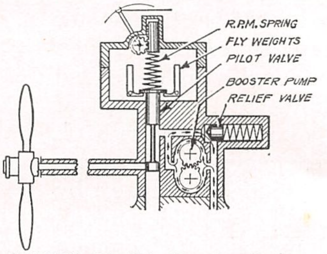
Constant Speed Propeller Protects Engine



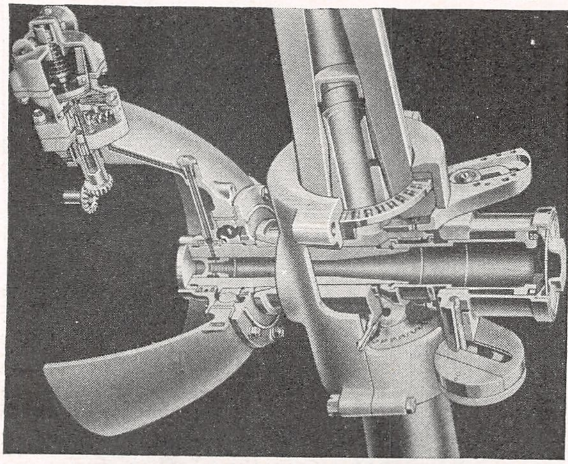
UNDERSPEED—High Pressure Oil Enters Propeller Line To Decrease Pitch



OVERSPEED—Oil Drains from Propeller To Increase Pitch



ON SPEED—Pilot Valve Closes Propeller Line To Maintain Pitch

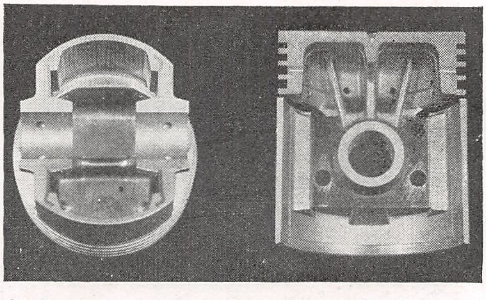


Top, illustrating oil control of propeller at over, under and on speed. Left, cutaway showing mechanism for controlling propeller's speed regardless of engine revolutions

Protection of the airplane engine is afforded by the Hamilton constant speed propeller which is controlled by oil pressure. The primary function of such a propeller is to permit the engine to run at the desired number of revolutions per minute, regardless of altitude or forward speed of the plane. It acts as a governor, holding the revolutions per minute constant no matter whether climbing, diving or flying level. From another standpoint, it acts as a controllable load, permitting the engine to develop as much of its full rated power as the pilot wishes. This is accomplished by automatic change of propeller pitch. In the Hamilton, the pitch is shifted by oil pressure. Counterweights acted on by centrifugal force provide the operating force to move the blades toward high pitch and the oil pressure works in the opposite direction against the counterweights, setting the pitch to any intermediate between full low and full high. Pitch is automatically selected by a separate unit called the constant speed control which regulates the oil pressure in the propeller operating cylinder. A simple gear pump boosts the engine oil pressure to 180 to 200 pounds per square inch where it is maintained by a relief valve. Although considerably less pressure is normally required to shift pitch, this high value is desirable to give responsive pitch changing action when needed.

Expansion Control in Piston Increases Efficiency

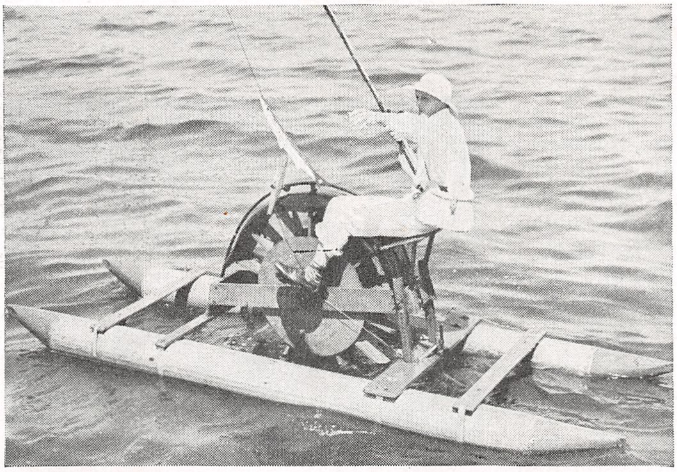
Thermostatic control of expansion is built into the new Bohn aluminum alloy piston which is standard equipment on several 1937 automobiles. The piston is designed to compensate for the difference in the rates of heat expansion of the cast-iron cylinder and the aluminum piston. It has steel inserts or plates shaped like



Sectional view of new piston, showing built-in steel strips which help control expansion invar struts used in an earlier piston. These inserts are formed from low-carbon steel and set into the mold so their ends are anchored in the aluminum of the piston skirt. The strips are paralleled by aluminum over their entire length and these parallel members of steel and aluminum form a thermostatic element. Since the aluminum, when heated, expands more than steel, the element will assume a curved form. Thus, in manufacture the piston skirt at room temperature is ground oval. As the piston heats up, the thermostatic unit causes the skirt to approach cylindrical shape without pressure from the cylinder, thus maintaining a close working clearance without undue friction. The degree of the working fit can be varied to suit conditions by properly proportioning the thermostatic elements. Thus the piston can be adapted exactly to the characteristics of any engine, increasing efficiency. The piston is designed to reduce skirt friction and to prevent skirt collapse and contraction, the cause of piston slap during cold starts.

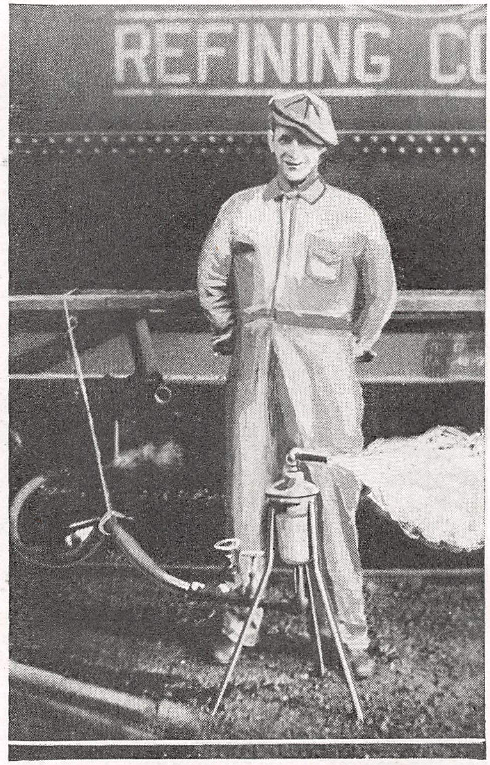
Fisherman Uses Water Bike for Deep-Sea Angling

Consisting of a bicycle mounted on pontoons, an odd-looking craft is being used for deep-sea fishing by Barney Fry, California sportsman. The water cycle is propelled by a paddle wheel. Its speed in rough water is about ten miles per hour.



Sportsman on specially designed water bike lands a fish while angling in deep water. Note how pedals drive paddle wheel

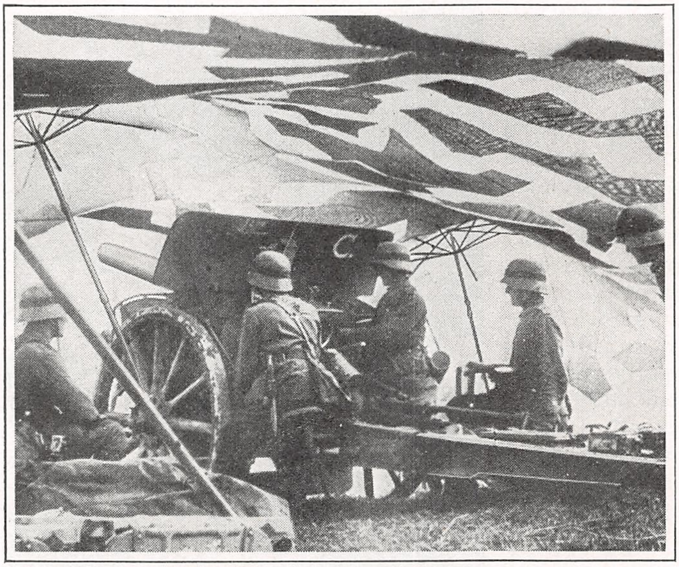
Tank Car Heated Faster with Portable Trap



Portable trap with rubber hose connections speeds up heating of tank car without requiring adjustment

By means of a portable trap devised by an oil company engineer, the time required to heat a tank car has been cut from five and one-half to three and one-half hours, a saving of thirty-six per cent. Bothered by the inefficiency of manually operated valves on the heating system, the engineer rigged up a trap on a tripod frame with rubber hose connections. The trap requires no attention, whereas several adjustments had to be made before a car was heated in the old way. Now the pressure in the boiler holds steady and considerable fuel is saved.

Patchwork Quilt Camouflage Hides Field Gun from Planes



German field artillery unit in practice maneuvers is shielded from view of observation and bombing planes by canopy of camouflage

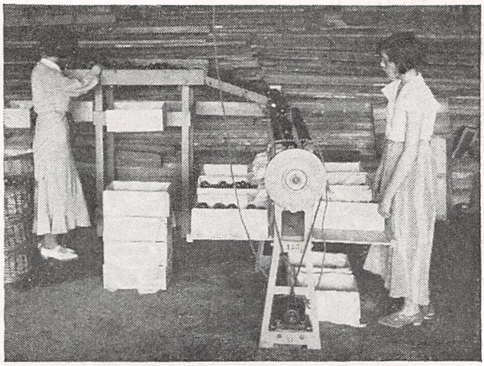
Camouflage resembling a broad patchwork quilt supported by umbrella-type standards hid German field artillery during the recent army maneuvers. Only the muzzle of the gun was exposed, its carriage and crew being effectively concealed from the "enemy" in observation planes high above.

Alcohol from Crops of Tropics May Be Fuel of the Future

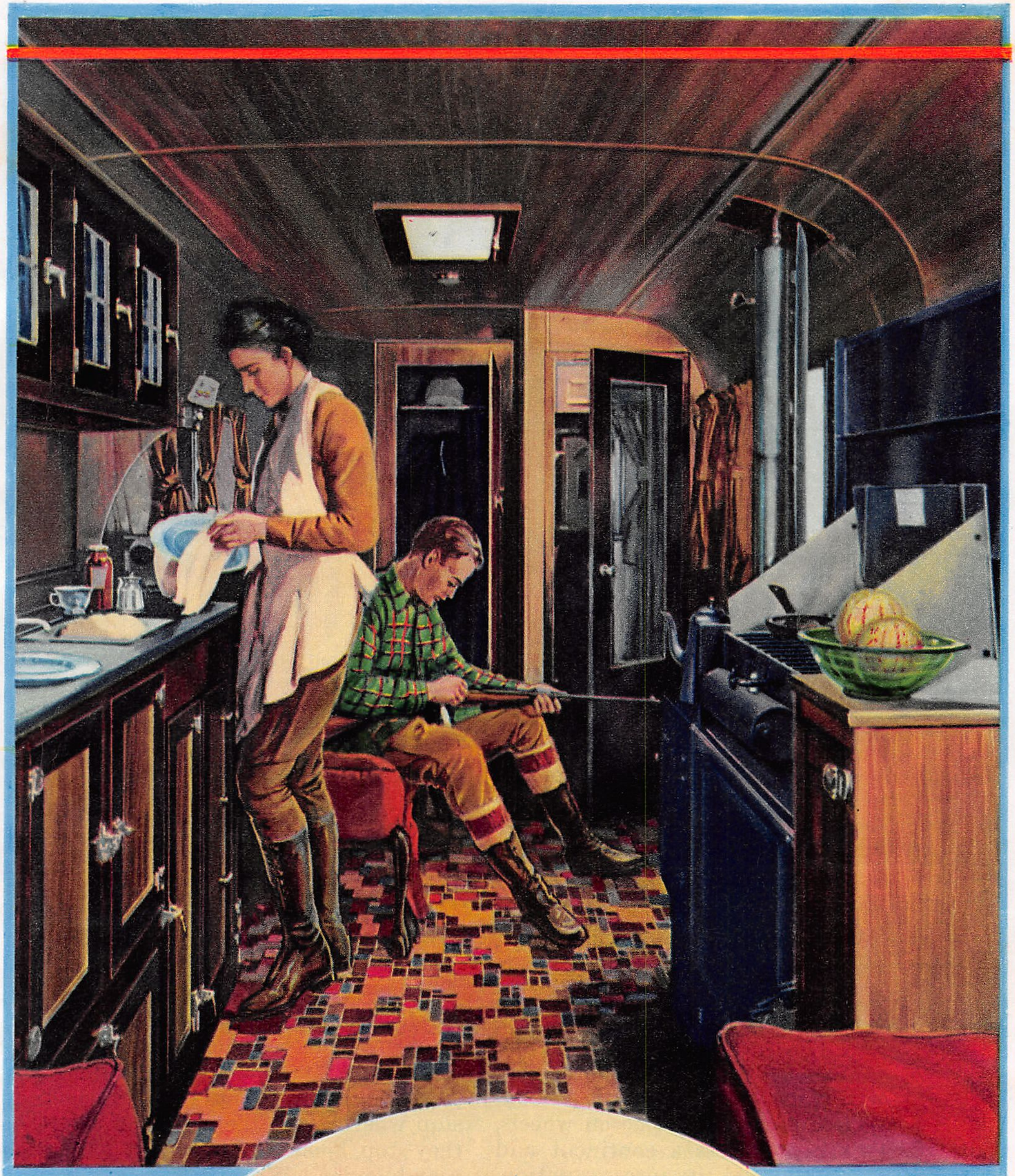
If dwindling oil supplies force the substitution of alcohol for gasoline, the world may turn to the tropics for this fuel. Dr. Edison Pettit of Mt. Wilson observatory estimates that it would take a half million square miles, nearly the entire annual grain crop of this country, to supply alcohol to replace the gasoline now being consumed. He suggested that fertile tropical lands may become increasingly important in the world's future development as producers of sugar-bearing plants. Utilization of sun power would not solve fuel problems, he said, since solar radiation yields only one horsepower per square yard at 100 per cent efficiency, and at current gasoline consumption rates motor vehicles in this country would require all the solar power available in 100 square miles of desert. Dr. Pettit said the world should use coal and save its oil, for the fuel problem must be solved within fifty years.

Tomatoes Graded Automatically by Machine

Seven different sizes of tomatoes are selected by an automatic grader used in England. The fruit is carried along on spiral rollers until it reaches a groove large enough for it to drop into a rubber-padded chute. From that point the tomatoes are delivered into boxes for marketing. The larger tomatoes go into the box most distant from the starting point. Each chute for delivering the fruit into the boxes automatically tips back when the box is removed and the tomatoes collect until another box is put in place. The grader, operated by a small electric or gasoline motor, handles half a ton of tomatoes per hour, with one row of fruit moving. A double-row machine handles one ton.

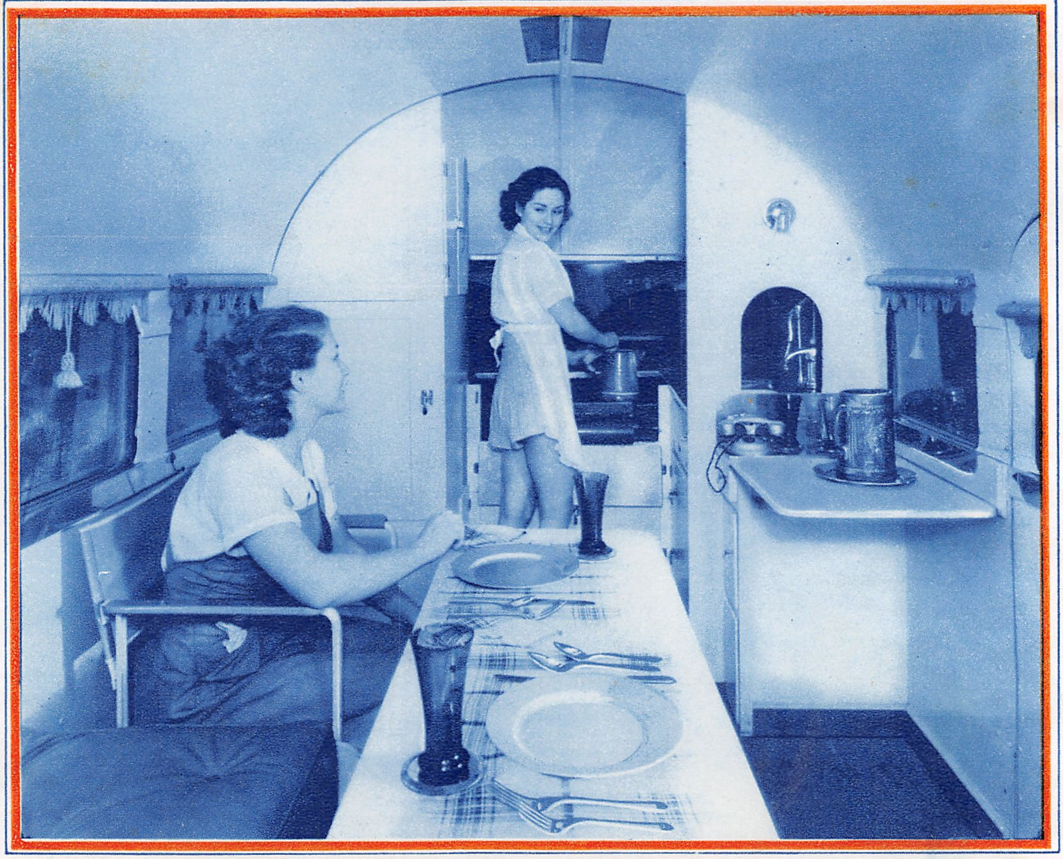


Tomato grader in operation. This type handles 1,000 pounds of tomatoes per hour



HITCH YOUR WAGON TO A CAR

INTERIOR of a modern trailer coach, showing the compact arrangement of the many conveniences and luxuries.



COLLAPSIBLE dining table in trailer coach. Note telephone set at right which connects through plugs to driving compartment of tow car.

By H. W. MAGEE

PART I

THE canvas-topped prairie schooner, the original home on wheels, crawled across a continent and transformed it into a nation. This slow, clumsy conveyance carried the pioneers and their meager belongings across the plains and pushed our frontiers westward to the Pacific.

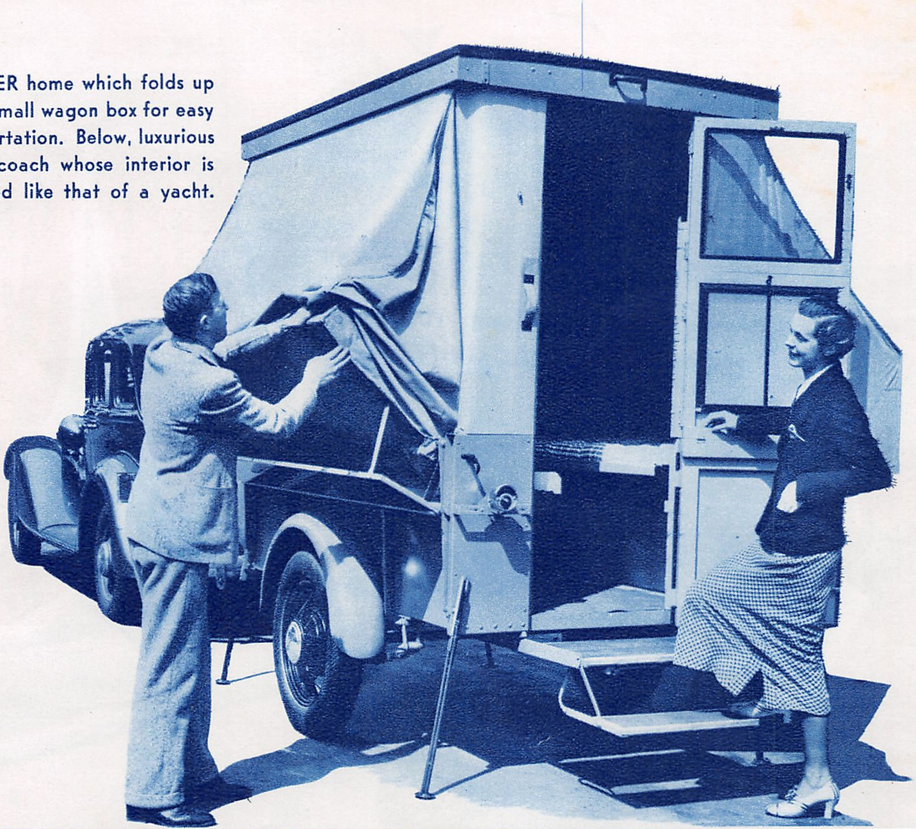
Today America is returning to the covered-wagon era, and the modern covered wagon again is extending our individual boundaries by releasing us from permanent abodes and providing a mode of travel so comfortable and inexpensive that we are likely some day to become a nation of nomads.

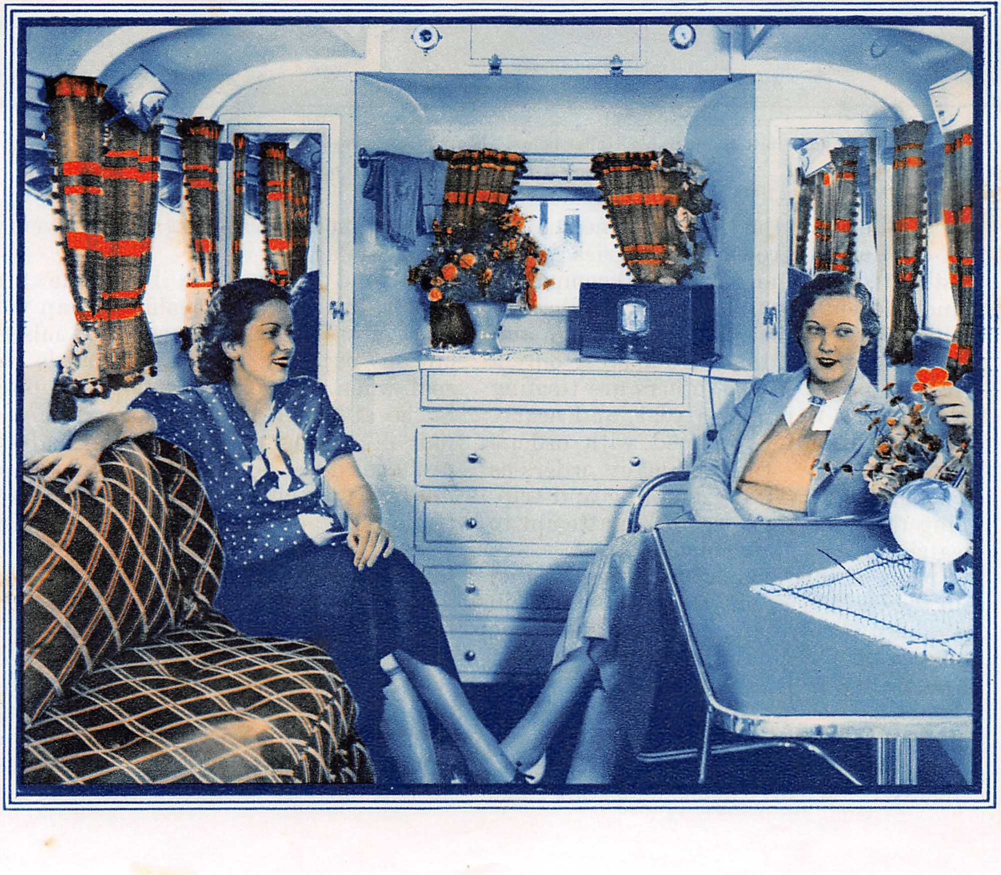
Today's prairie schooner is a streamlined, luxury-crammed "cottage" on rubber-tired wheels. It is hitched to a 100-horsepower car instead of to a team of oxen. Thousands of families are towing these rolling homes behind their cars today, living in them as they travel. They stop where fancy dictates, and wherever they stop, home is waiting just behind the rear bumper. When they tire of sitting still, they move—and take their home along.

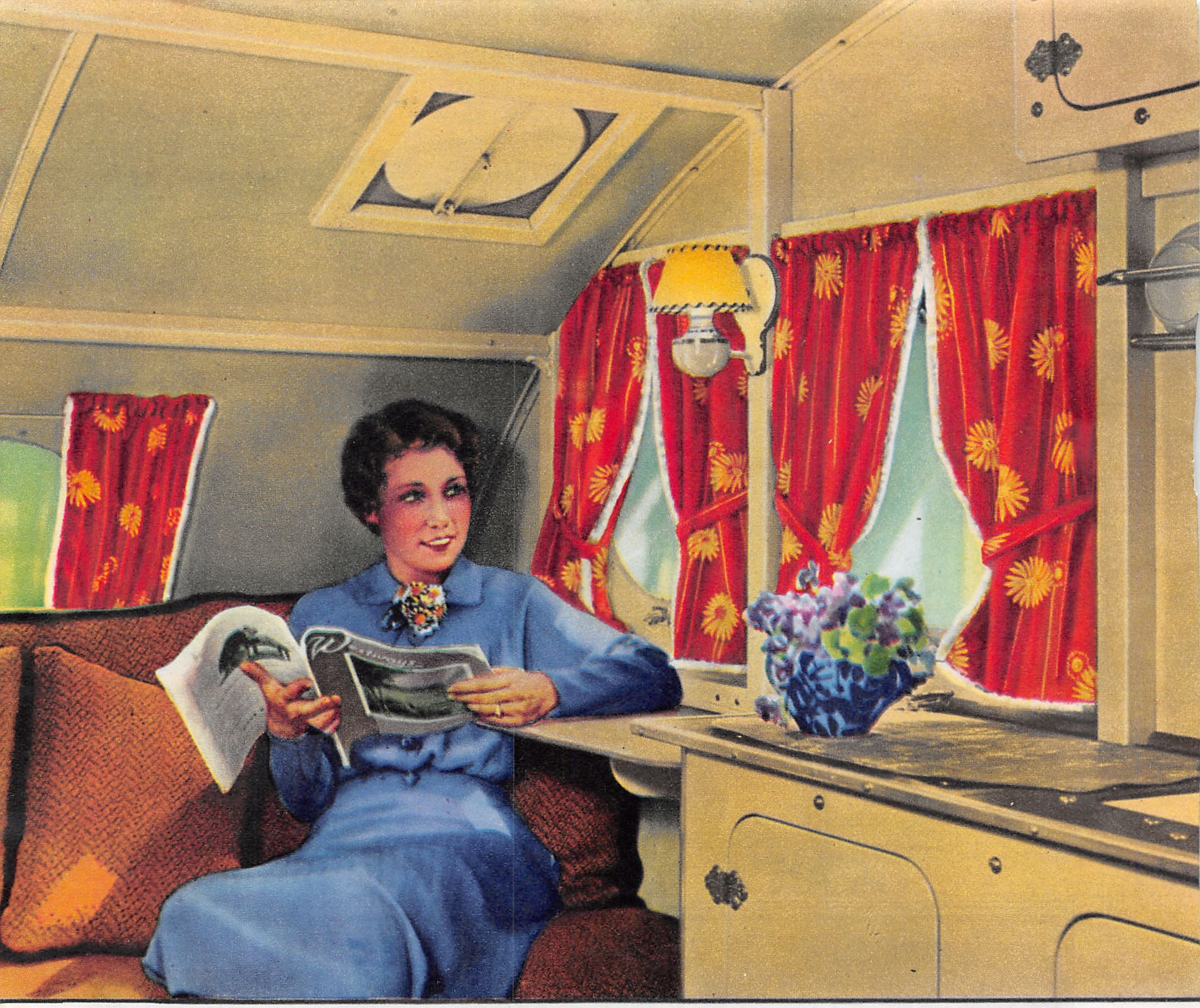
Trailers have given travel a new meaning and a new value. Many have found, to their astonishment, that it is actually cheaper to travel and take their home along than to stay at home. Vacationists have discovered that the mobile home enables them to "camp out" in comfort and luxury. And industry is learning that the trailer showroom boosts sales by bringing the goods to the buyer instead of only a catalog or a picture of the product.

As a result, the country is clamoring

TRAILER home which folds up into a small wagon box for easy transportation. Below, luxurious trailer coach whose interior is arranged like that of a yacht.







COZY nook in a comfortable trailer home. Most modern trailers are equipped with folding furniture which is out of the way when not in use.

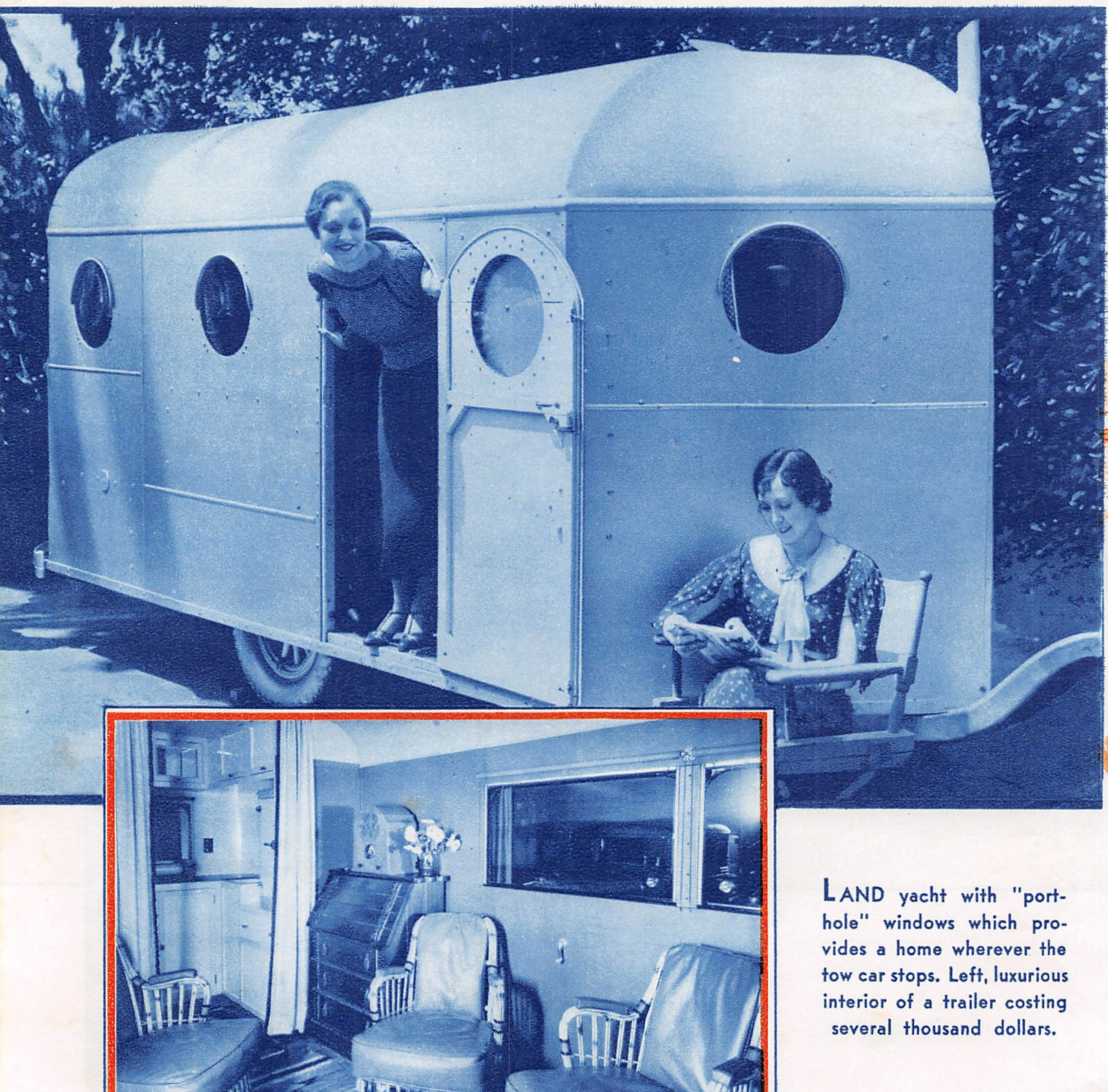
for trailers and the trailer business is one of the fastest growing industries. It is estimated there are about 400 companies and individuals turning out trailers of almost every conceivable size, design and shape. Some of them are making only a few units per month, others are turning out several thousand a year, and nearly all are literally swamped with orders. Some boast five times as many orders as can be filled and are doubling and tripling their factory space in an attempt to catch up with the demand.

Most of this demand has been created in the last five or six years, much of it in the last two years. It has been due mostly to the overnight development of the trailer from a box on wheels into a land yacht as carefully designed and engineered as your automobile. The modern trailer coach bears no more resemblance to the early homemade trailer box than do modern cars to those of twenty-five years ago.

No one knows who built the first trailer, but it was probably a chap who tired of strapping suit cases and miscellaneous baggage to running boards and roof when he took the family camping. So he attached a box to an axle and a pair of wheels and thought he had the problem solved until the poorly balanced, improperly mounted and crudely hitched trailer began bouncing, swaying and weaving behind him, making vicious side lunges at every passing motorist.

Automobiles improved with the years, but no one did much about the lowly trailer. It was a sort of poor relation, towed along if it couldn't be left behind, a noisy, unsightly and usually unruly appendage of the baggage-laden tourist or camper. Today's factory-built trailer is as well built as your car. Inside it may

TRAILER owners park in comfortable camps equipped with running water and electrical outlets. Above is a typical camp scene. Right, the "living room" of a rolling home.



LAND yacht with "porthole" windows which provides a home wherever the tow car stops. Left, luxurious interior of a trailer costing several thousand dollars.

be as many luxuries and conveniences as your purse can afford.

The trailer industry is a young one and you are not limited to many standardized designs, shapes, colors or sizes. If you're thinking, as thousands are, of buying a trailer and seeing the world, your choice need only depend on the size of your bankroll and your family. There are utility trailers consisting of bullet-shaped overgrown trunks riding on one wheel, telescoping trailers which expand to several times their road size, trailers which are converted into tents, trailers with shower baths, trailers with bath tubs, trailers with air conditioning systems, trailers with interiors modeled after the cabin lines of power yachts and trailers with floors which lower to increase the head room. No one has built a trailer with a basement yet, but two-story trailers like double-deck buses may be just around the corner.

Costs range all the way from $300 or

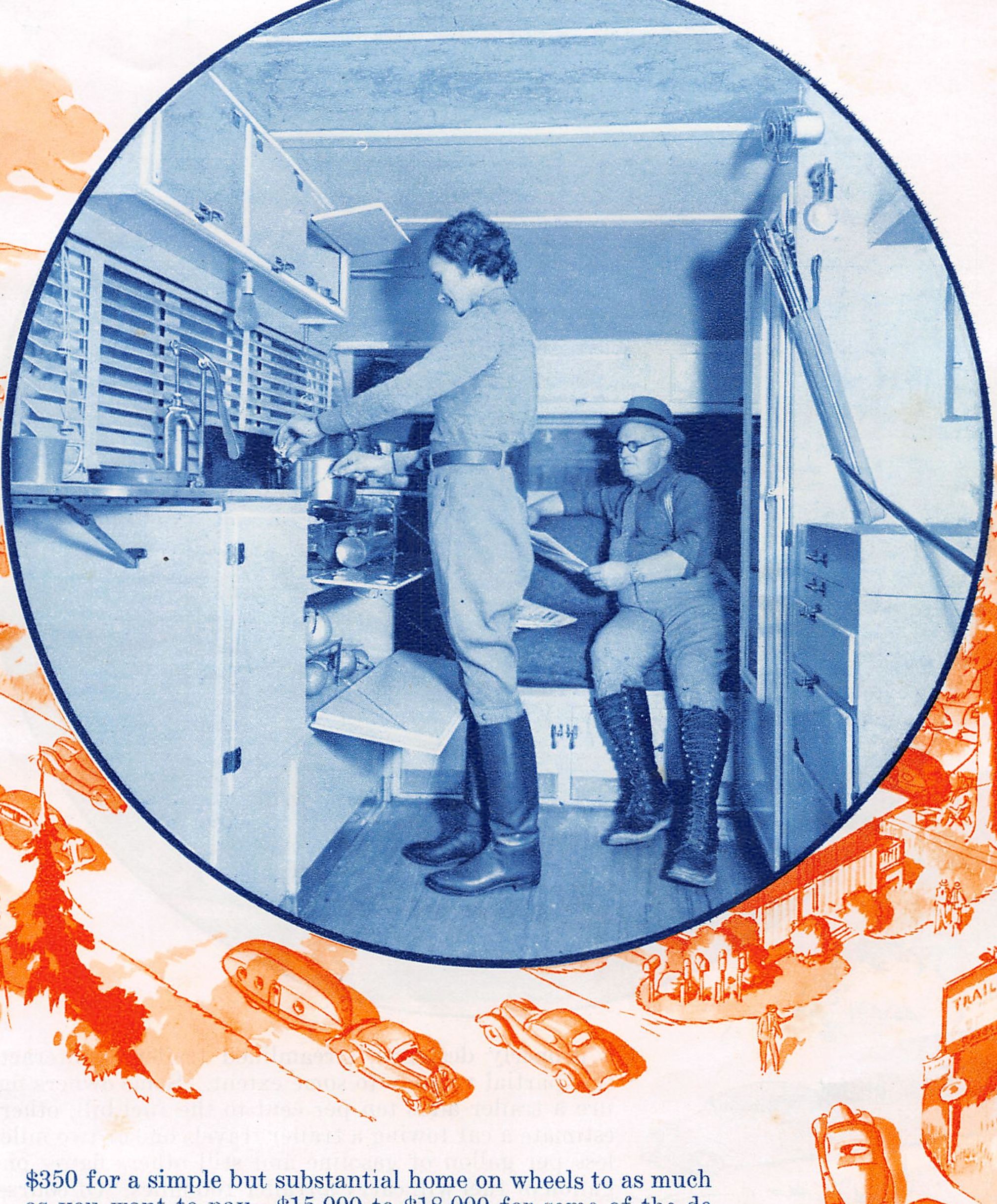


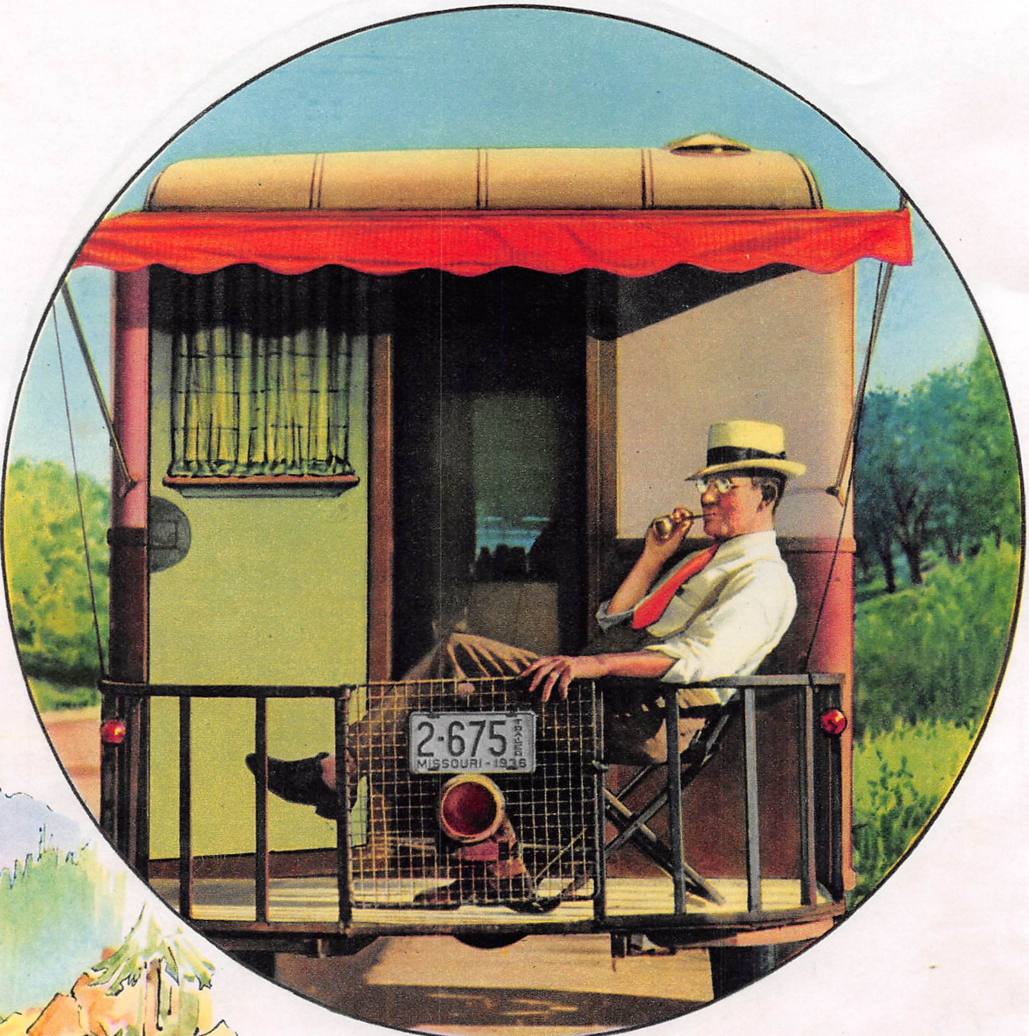
Photo courtesy Automobile Club of Southern California

GALLEY of modern trailer, showing gasoline stove, ice box and food compartments. Note the electric fan and the electric lights.

$350 for a simple but substantial home on wheels to as much as you want to pay—$15,000 to $18,000 for some of the de luxe jobs offering in compact form most of the luxuries, comforts and appointments of the finest home. Standardization, mass production and in-line assembly probably will reduce costs as soon as the industry becomes more stabilized.

Weights range from around 1,000 pounds to more than 4,000 for the big ones, and lengths run all the way from twelve to more than thirty feet, with an average of eighteen or twenty feet. A good car can tow one of these large trailers at speeds up to sixty miles per hour. Of course, the higher the speed, the higher the fuel bill, although towing a trailer adds surprisingly little to fuel consumption, considering the size and weight of the vehicle you are pulling.

The drag of the air behind your car costs you gasoline and



SOLID comfort on the "front porch" of a trailer home. Thousands of families are making their homes in trailers the year round.

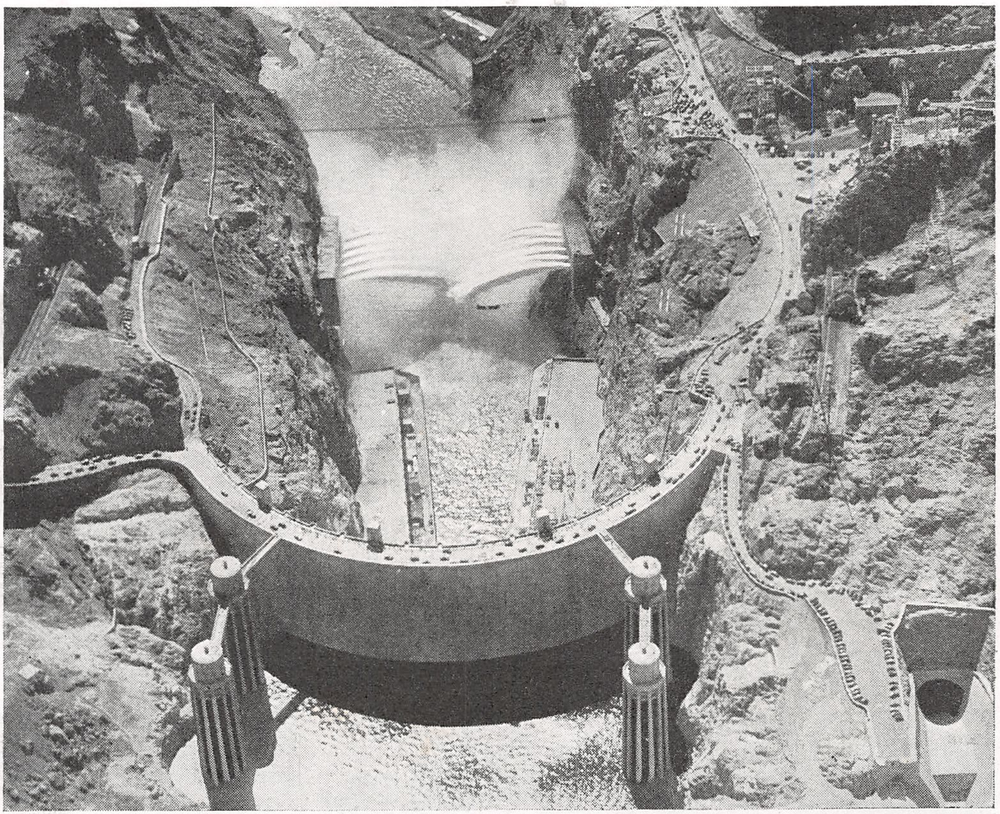
a properly designed, streamlined trailer counteracts this partial vacuum to some extent. Some owners figure a trailer adds ten per cent to the fuel bill, others estimate a car towing a trailer travels one or two miles less per gallon of gasoline and still others figure one gallon of fuel will carry a trailer 100 miles. Of course, much depends on the weight, design and size of the trailer.

High wind naturally increases the fuel consumed, and of course a trailer cuts down the pick-up of your car at the red light and you'll need to exert more pressure in braking unless your trailer is equipped with individual brakes. Some of the more expensive ones have their own brakes which are hooked up electrically or hydraulically with the car's braking system, but the more economical units are without separate brakes.

Most trailers have one thing in common. Space is at a premium so everything is designed to fold up, col-

(Continued to page 132A)

Giant Boulder Dam Starts Generating Power

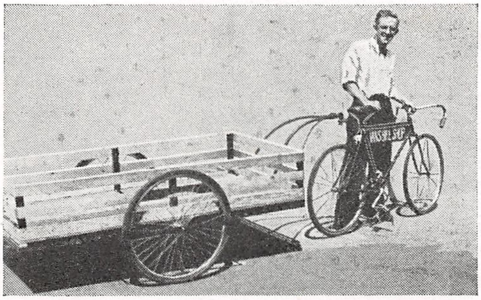


Remarkable view of Boulder Dam on the day that generation of power started. This is how the giant project appeared from the air when outlet gates were opened. Note automobiles on top of dam

When twelve outlet valves were opened at gigantic Boulder Dam recently, the Colorado river was put to work generating electrical energy for millions of people. That marked completion of the $168,000,000 dam which holds back the river until the water is required to run the big generators in the powerhouses. Electricity will be conducted from the powerhouses to several western states.

Bicycle Rider Hauls a Trailer for Deliveries or Touring

Touring with a trailer is not confined to motorists. A Californian built a bicycle trailer from a pair of bicycle wheels, old lumber and strap iron. It can be hooked to any bicycle and used for a camping trip or for delivery of parcels in the city. The trailer floor is three by six feet, large enough for a bed, and is sturdy enough to carry 500 or 600 pounds.



Although light in weight, this trailer is large enough to make up as a bed on a camping trip

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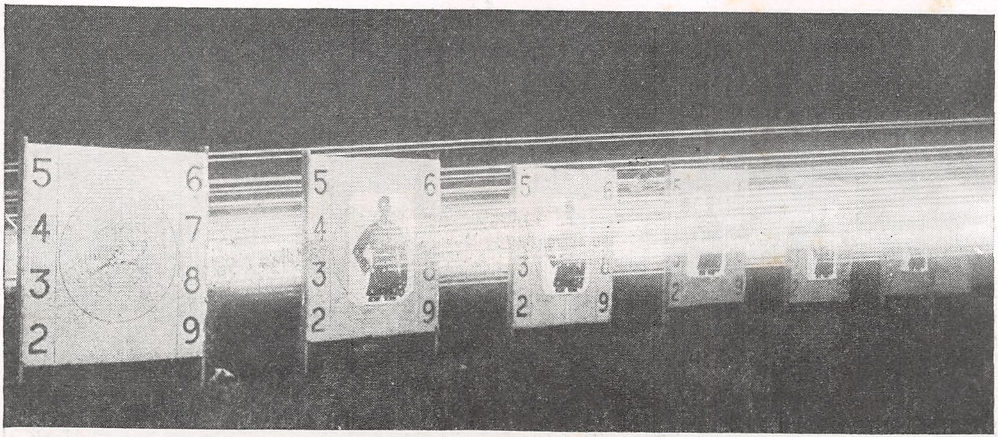
¶Production of salt from sea brine is expected to be on a commercial basis in Japan next year.

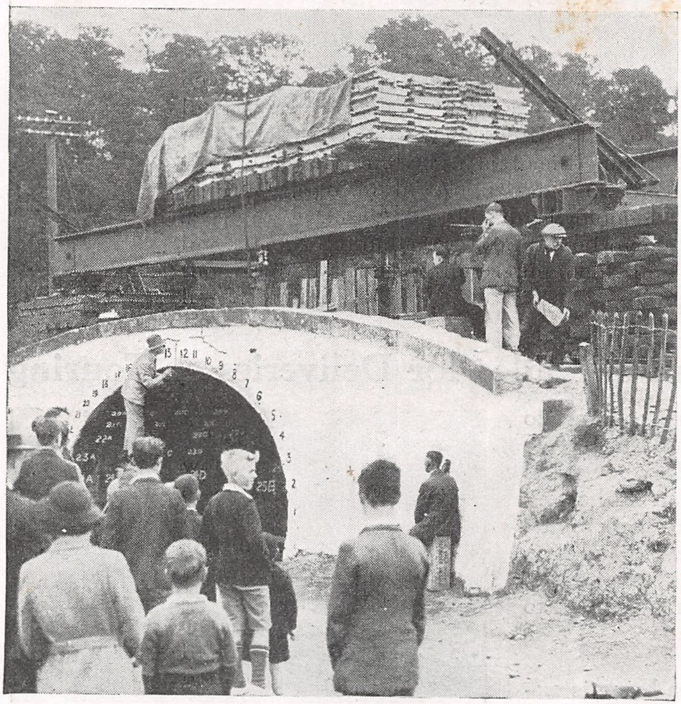
Tracer Bullets Riddle Target in Night Firing



Each streak of light pictured here marks path of a tracer bullet fired at targets by coast guardsmen. Note large number of "hits" on target second from left, evidence of remarkable accuracy

When coast guardsmen were practicing night shooting recently, a photographer snapped a rare picture of tracer bullets riddling the targets. The tracer bullets marked the course of the shots, showing the accuracy of the marksmen. The effect of hundreds of them flying about the targets resulted in an unusual photograph.

Ninety-Ton Load Wrecks Old Bridge in Building Tests



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Old bridge at moment it was subjected to load of ninety tons. Note cracks in the arch. Shortly after picture was taken, it crashed

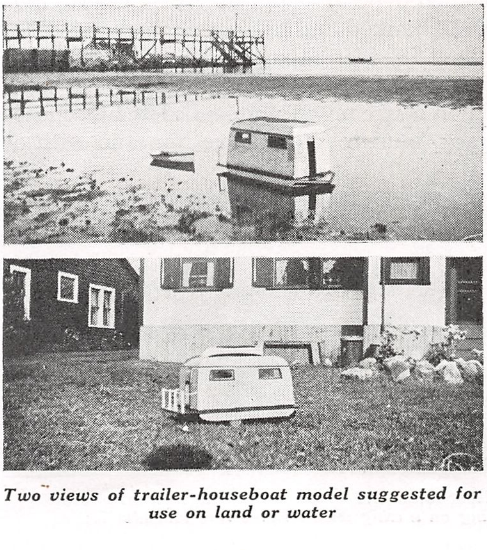
In experiments to determine the strength of bridges and requirements for rebuilding old structures, English experts subjected a 140-year old bridge to a load of more than ninety tons before it crashed. Throughout this test readings were taken of the deformation and the internal strains placed on the arch by the load.

Porous Metal Is Used for Lampwick

Metal which can be used for wicks in kerosene lamps or stoves is being investigated by scientists. It is prepared by reducing copper or iron to a powder and then compressing it with a pressure of several thousand pounds per square inch. A brief heat treatment completes the process, the finished product resembling other metal but being lighter in weight. A drop of ink placed on the metal runs into microscopic cracks between the powder grains, in the manner of a blotter. A piece of the metal set in kerosene is porous enough for the liquid to work its way to the top and it can be ignited like any other wick.

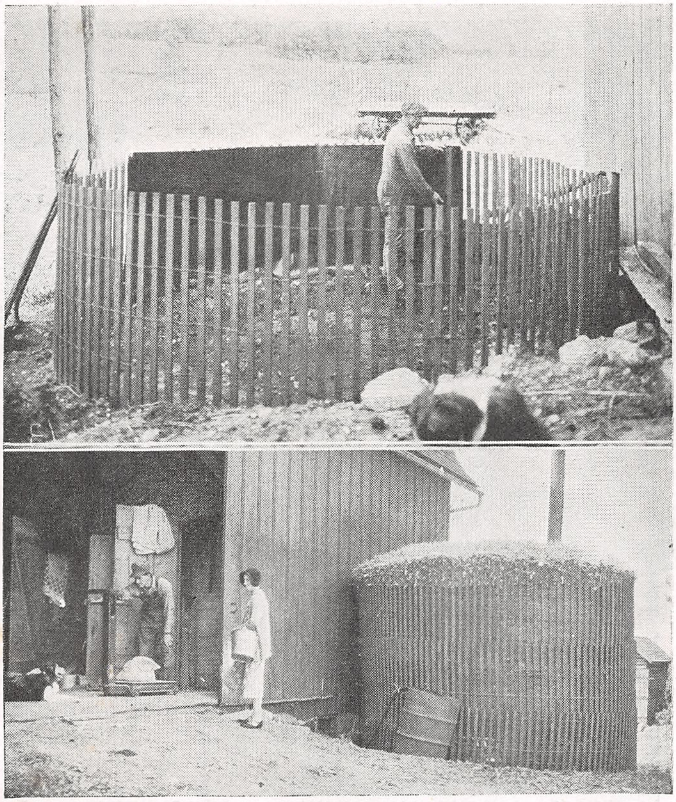
Amphibian Trailer Constructed in Model Form

Constructed in miniature form for test purposes, an amphibian trailer is the latest suggestion for the tourist. The trailer would be used in the usual manner on land, but on the water it would become a houseboat, floating on its watertight pontoon base. An outboard motor would propel the trailer.



Two views of trailer-houseboat model suggested for use on land or water

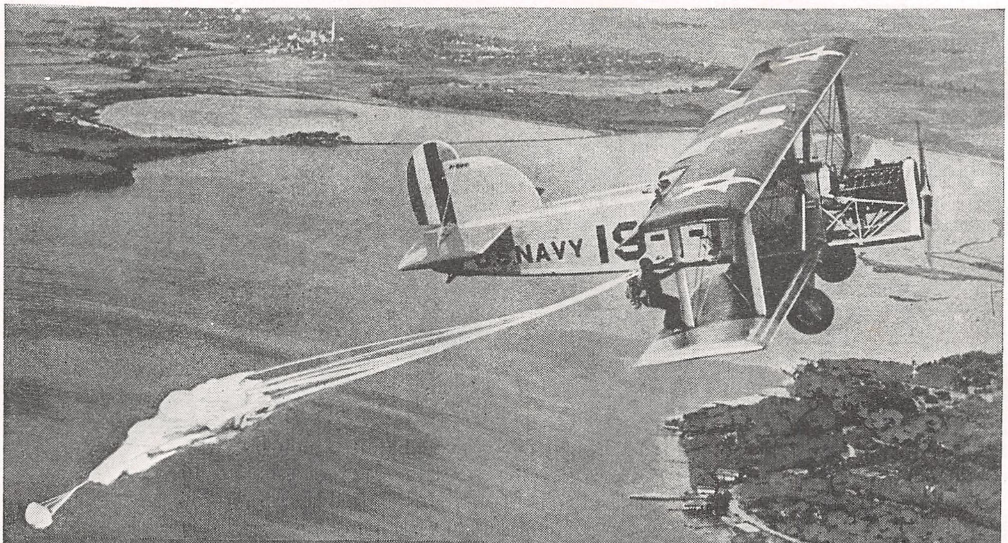
Portable Silo Easy to Make with Paper and Snow Fence



Portable build-your-own silo. Top, lining it with special treated paper. Bottom, silo filled and covered with packed straw

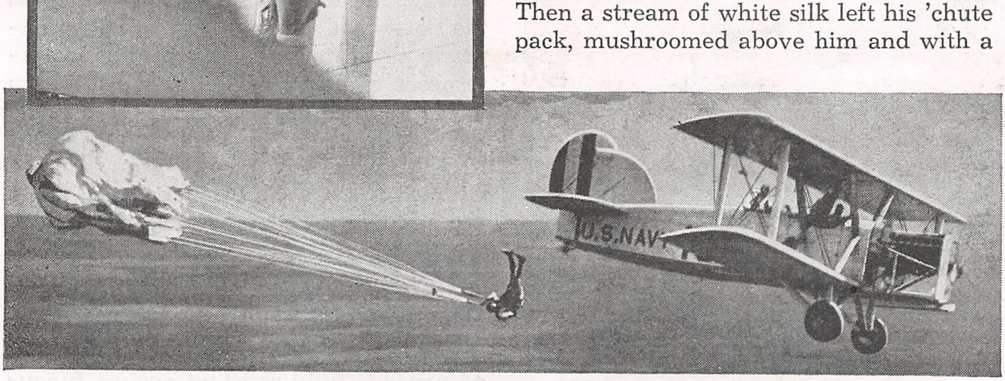
Designed for quick assembly by the farmer, a portable silo can be constructed of four-foot snow fencing and lined with a new type of craft paper. The farmer laps the slats wood to wood and the lining, paper to paper, to make an airtight and waterproof enclosure when expanded from within by the weight of the contents. The top of the filled silo is covered with about fourteen inches of packed straw soaked with water and seeded with oats. The heat produced by the fermenting silage soon sprouts the oats and thus provides protection against the air. After the silage is used the fencing may be rolled up and stored until next season when it can be used with a new lining. The specially treated paper is fully resistant against fungus growths and bacteria existing in all silage.

The CATERPILLARS



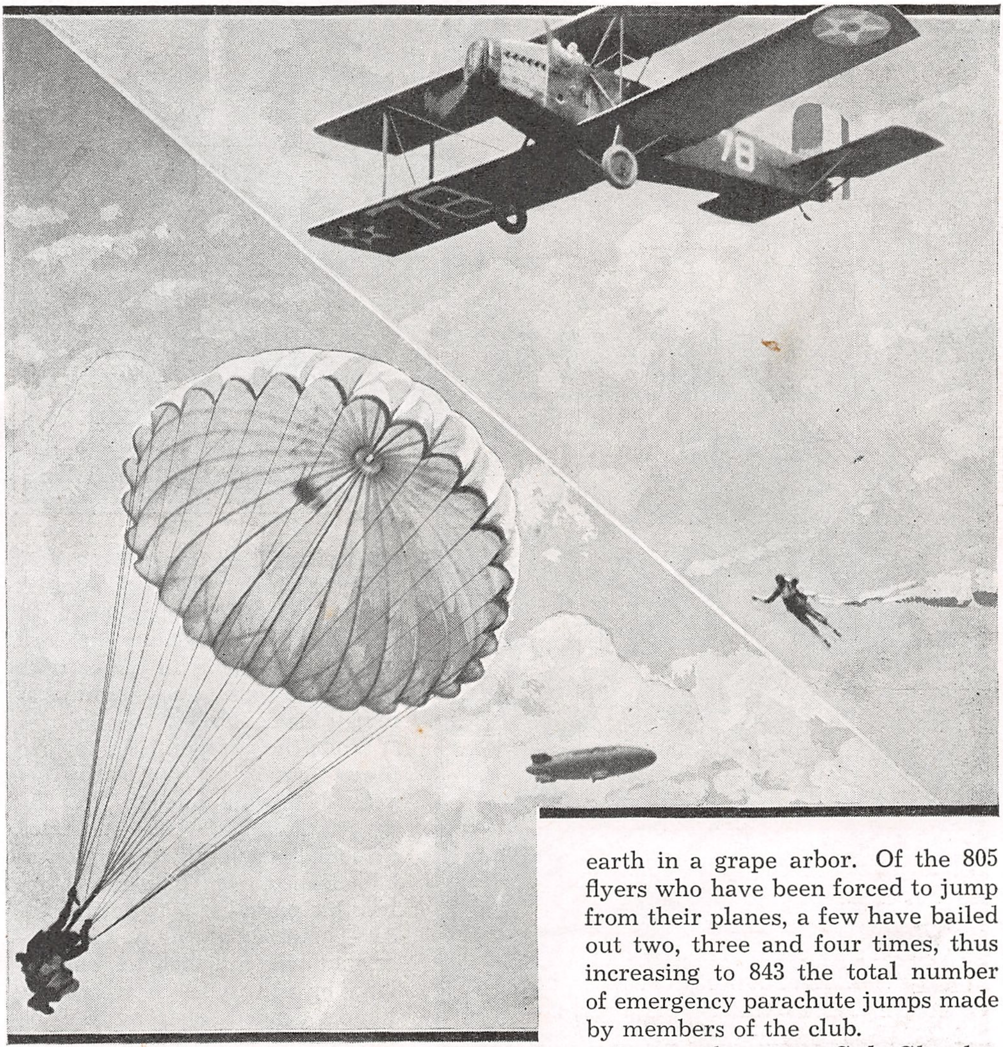
THE big B-12 army bomber had no observation window. As it droned over Mather Field, Calif., to drop a few practice bombs, Flying Cadet J. A. Phillpot, with a scoreboard in one hand and a microphone in the other, leaned out through the bomb bay to make his observations.

Released from its rack, a bomb sped earthward. Eagerly Flying Cadet Phillpot leaned over to watch it. As he did so, the B-12 banked and he was pitched out. For about 100 feet he tumbled head over heels, a grotesque object in the cloudless sky. Then a stream of white silk left his 'chute pack, mushroomed above him and with a



When you make the pull-off jump, at top, you at least know the 'chute will open. Bottom photo shows jumper a second later. Center, standing on a wing with 'chutes fore and aft

STILL FLY!



This man floats through the air with the greatest of ease. One at top has just leaped from cockpit

snap checked his headlong rush. Slowly and sheepishly, Cadet Phillpot floated to earth. He had become a Caterpillar.

There have been 805 names registered on the rolls of the Caterpillar Club since the first involuntary member, Lieut. H. R. Harris, after losing one of his wings, stepped out of his airplane over McCook Field in October, 1922, and came safely to earth in a grape arbor. Of the 805 flyers who have been forced to jump from their planes, a few have bailed out two, three and four times, thus increasing to 843 the total number of emergency parachute jumps made by members of the club.

Among these are Col. Charles Lindbergh, member No. 4, who was forced to jump four times. His first jump was made on March 5, 1925, when he was a cadet in the Army Air Corps Flying School at Kelly Field. Less than three months later, as a full-fledged lieutenant, on June 2, he made his second leap. He jumped the third time on Sept. 16, 1926, while flying the airmail over Ottawa, Ill. Two months after that he leaped again over Covell, Ill.

Top, the first thing to do when you land is deflate. Below, this jumper almost missed that tree

The Caterpillar Club is one of the most exclusive organizations in the world. It gets its name from the silken 'chute on which its members stake their lives. A flyer does not seek membership in the club. His initiation generally comes as a complete surprise to him when, face to face with some aerial accident or mishap, he is forced to jump. The club has but one rule and that was evolved at Kelly Field some years ago. A newly initiated member must hold onto his parachute rip cord after he has made his jump. If he fails to do so, he must stand treat for all his comrades.

While the parachute, in various forms, was in use for nearly 150 years before the airplane was invented, until 1919 it was employed principally by exhibition jumpers who leaped from balloons. During this period it was not a true, self-contained aerial life preserver, but was attached to the balloon or plane from which the jumper leaped, cutting the attached cord as he did so.

During the world war, science began to pay attention to the parachute as a means of saving the lives of pilots. In July, 1919, two balloonists, Henry Wacker and John Boettner, took to 'chutes when the Goodyear blimp, "Wingfoot Express," caught fire above Chicago. Although Wacker and Boettner landed safely, the Caterpillar Club itself did not come into existence until 1922 when Lieut Harris made his successful leap from a heavier than air machine.

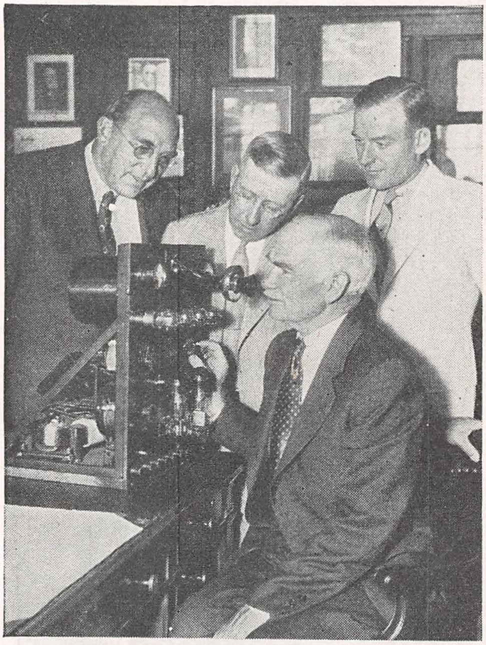
Above, bailing out over New York harbor. Right, landing in water with danger of drowning

Since that time, with the development of the modern 'chute, thousands of jumps have been made in safety from altitudes as high as 26,500 feet, made by Capt. A. W. Stevens, the aerial photographer, and from as low as 100 feet, made by Floyd Smith in a "pull-off" jump from the wing of a navy seaplane at Anacostia.

It is one thing to make a practice or exhibition free jump or pull-off jump when weather conditions are right and the pilot aids by controlling the airplane. It is something entirely different to make a leap for life from a crazily spinning plane, one that has lost its wings or one whose engine has been torn from its fuselage. Yet these are the conditions faced by the members of the Caterpillar Club. How does it feel to become a Caterpillar, to bail out of a plane doomed to crash in the next few seconds,

(Continued to page 146A)

Oldest Radio Station Celebrates Its Sixteenth Anniversary



Broadcasting over the original transmitter sixteen years after it carried the first radio program

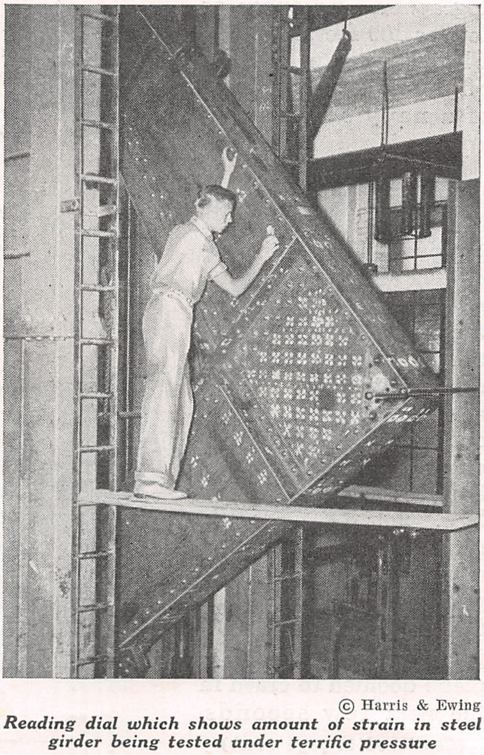
Only sixteen years ago the first regular entertainment program by wireless was broadcast. Program broadcasting originated with Station WWJ of the Detroit News in 1920, and at a sixteenth anniversary program in August one of the speakers was Dr. Lee De Forest, pioneer inventor of the industry, who talked over the original transmitting equipment he had devised.

Enzyme's Secret Is Revealed by Spectroscope

Detection of the mysterious enzyme at work is the latest accomplishment of science, achieved by using the spectroscope. An enzyme is one of several complex substances such as pepsin, capable of transforming by catalytic action some other compound. It is important to man because it causes organs of the body to function and because it is essential in baking bread, making cheese, curing meats and brewing beer. At death, the body is converted into "dust," or rather into the separate chemical elements from which the body is composed, by enzymic action. Dr. Kurt Stern, visiting lecturer at Yale University, detected the reaction of the enzyme with the spectroscope. He mixed an enzyme called catalase, which is identical with the color pigment, hemin, found in blood hemoglobin, with a derivative of hydrogen peroxide. Under the spectroscope the spectrum of the enzyme disappeared and a new spectrum from the chemical combination resulted. Then when the destruction of the peroxide was complete the characteristic spectrum of the enzyme reappeared. Thus, the entire cycle of enzymatic process was revealed.

Steel Girder Tested for Strain under 3,000 Tons Pressure

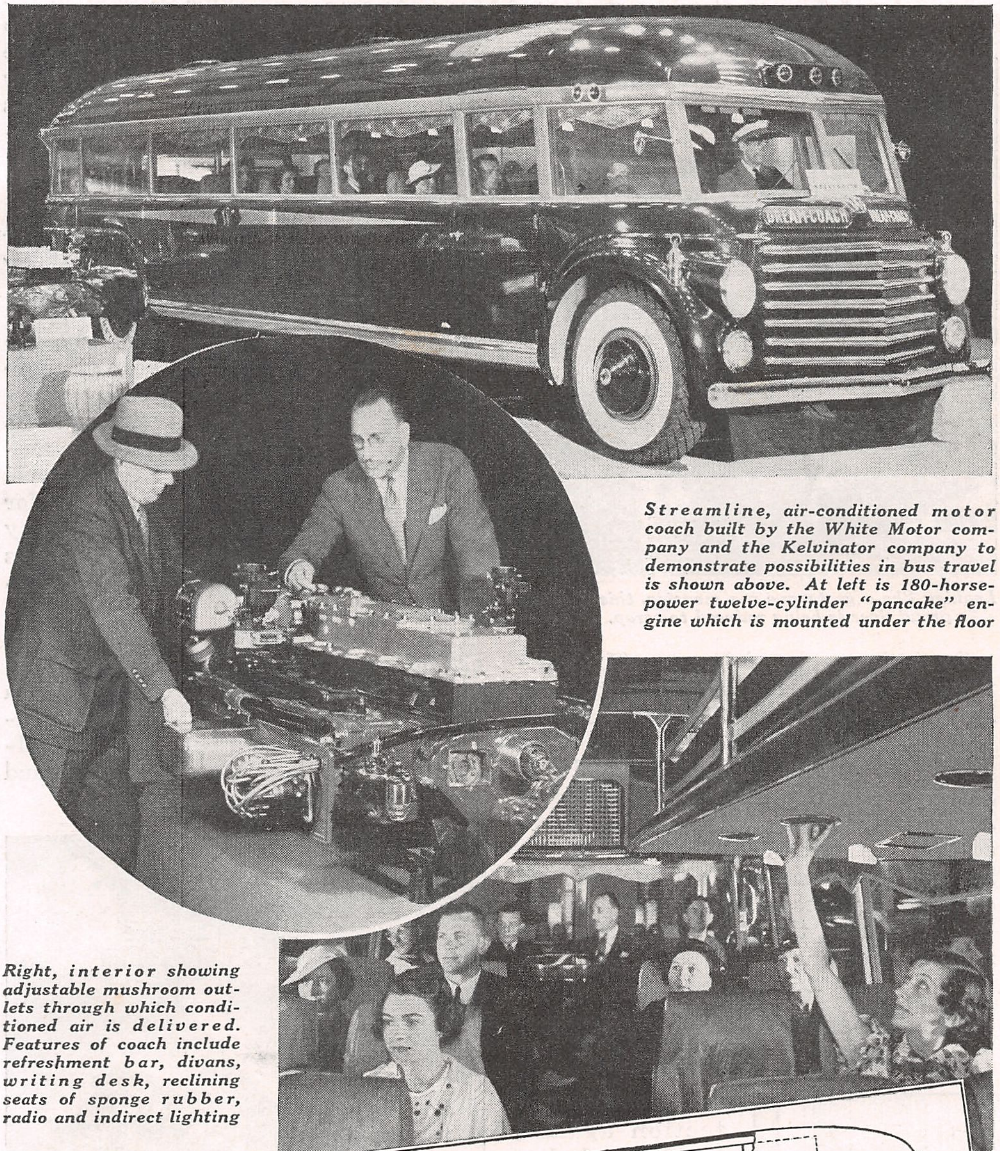
Just how much strain a steel girder can endure is measured by a testing machine at the Bureau of Standards which applies a maximum pressure of 6,000,000 pounds, either in expansion or contraction. The test can be applied to rope, beams or any rigid construction material.



© Harris & Ewing

Reading dial which shows amount of strain in steel girder being tested under terrific pressure

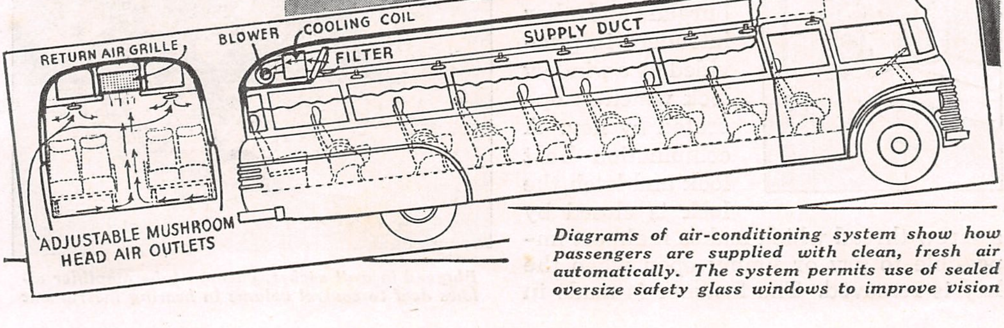
'Dream Coach' Complete to Air Conditioning



DREAM COACH

Streamline, air-conditioned motor coach built by the White Motor company and the Kelvinator company to demonstrate possibilities in bus travel is shown above. At left is 180-horsepower twelve-cylinder "pancake" engine which is mounted under the floor

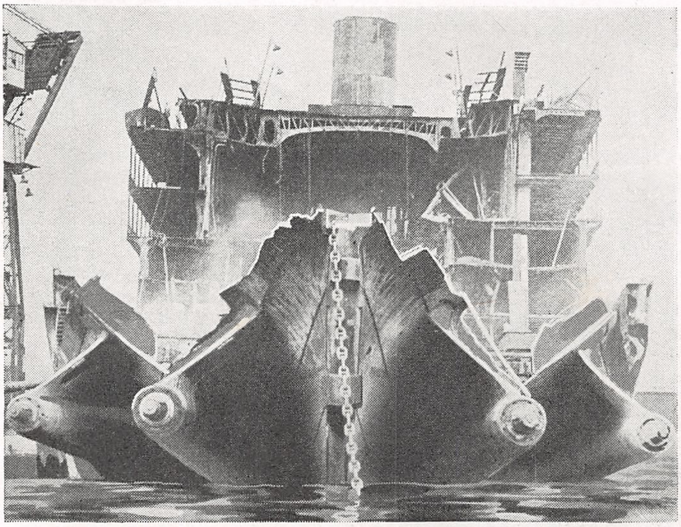
Right, interior showing adjustable mushroom outlets through which conditioned air is delivered. Features of coach include refreshment bar, divans, writing desk, reclining seats of sponge rubber, radio and indirect lighting



RETURN AIR GRILLE
BLOWER
COOLING COIL
FILTER
SUPPLY DUCT
ADJUSTABLE MUSHROOM HEAD AIR OUTLETS

Diagrams of air-conditioning system show how passengers are supplied with clean, fresh air automatically. The system permits use of sealed oversize safety glass windows to improve vision

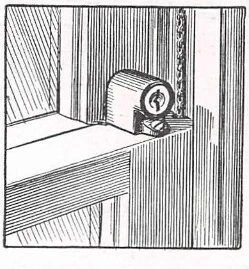
Ship That Never Put to Sea Is Dismantled by Wreckers



Looking like a grotesque sea monster, this floating skyscraper that was a proud liner is being reduced to scrap. It never saw service at sea

Once the pride of France, "L'Atlantique," the liner that never put out to sea, lies a skeleton in a Glasgow shipyard while wreckers pick at her bones. Fire gutted the giant ship during a trial run and ended its career before it was begun. After many months the charred and twisted hull was towed to the Scottish port to be wrecked for salvage, and now, almost denuded of plates and cut away nearly to the water line, the ship resembles some floating monster.

Key-Operated Window Lock Guards Against Burglar



Increased protection against burglars and other intruders is provided by a window lock which is operated by key. A combination bolt lock and latch, the lock is closed by a screw thread which makes it almost impossible to pry or jimmy open when the key is removed. The fastener is made in two models to fit both French and double-hung windows. If desired, the lock can be installed so that the window may be locked partly open for ventilation. Installation is simple, requiring no special tools.

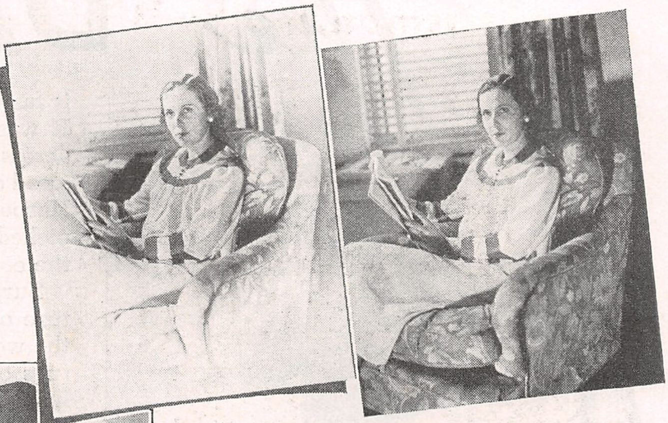
Hearing Aids Given Volume Control by Vacuum Tube

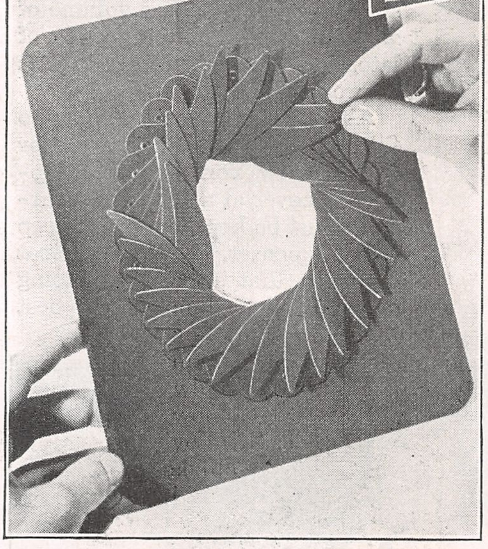
Deaf persons who use hearing aids can dispense with batteries by plugging their instruments into a vacuum-tube amplifier recently developed. It is adapted for use with almost any hearing aid which does not have its own amplifier attached permanently. The amplifier has an eight-foot cord which plugs into any alternating-current outlet and operates seven hours for about one cent. A volume-control button provides a wide range of volume for distant or near-by sounds and holds its level steadily.

Plugged in wall socket, vacuum-tube amplifier allows deaf to control volume in hearing instrument

Vignetter Blocks Out Irregular Background

Vignetter of black fiber board, below, has twenty-nine movable wings which can be maneuvered into irregular shapes for blocking out background in printing or enlarging photographs. Right, portrait printed with and without vignetter



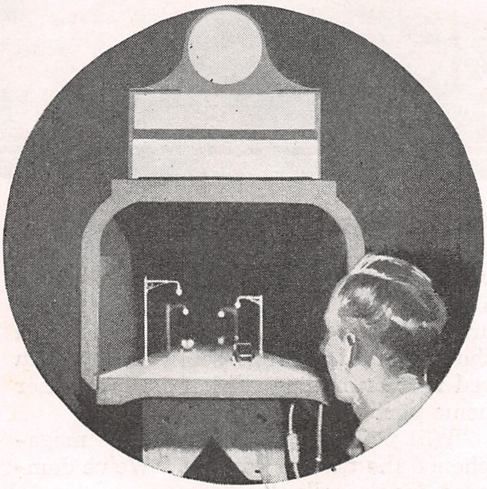


Blocking out the background of photographs in any shape—oval, round, or irregular—is made simple with a vignetter now available. Made of black fiber, it has twenty-nine movable wings which can be manipulated into almost any position desired. In printing portraits as well as other photographs it is thus unnecessary to cut a special vignette to fit the shape of a particular picture. The movable wings are merely maneuvered to the proper outline and the vignette laid in position under the enlarger or printer.

¶Colored fabrics of asbestos are used in England for the manufacture of fireproof rugs, kitchen aprons, table covers and curtains.

Highway Model Has Lighting Designed for Safety

Used by General Electric engineers to illustrate the safety principles involved in the illumination of roads, a portable model highway has tiny automobiles, pedestrians and lights. The miniature equipment demonstrates how a well-designed lighting system reveals pedestrians clearly by silhouette under conditions in which automobile headlamps are dangerously ineffective. The model was displayed and demonstrated recently during a convention of the Illuminating Engineering society in Buffalo, N. Y.



Looking into one end of portable model of highway. Note system of illumination

The DARE-

THE tug was in luck. It was beating up the Jersey coast at daybreak when it was hailed off the starboard bow. The skipper gave two gongs to the engineer, and spun the wheel. The call came from the bridge of a single-screw tramp with red rust crumbling off her hull, and her home port was Liverpool.

"Will you stand by for a line?" megaphoned the tramp's captain. "We've damaged our propeller."

"Where to?"

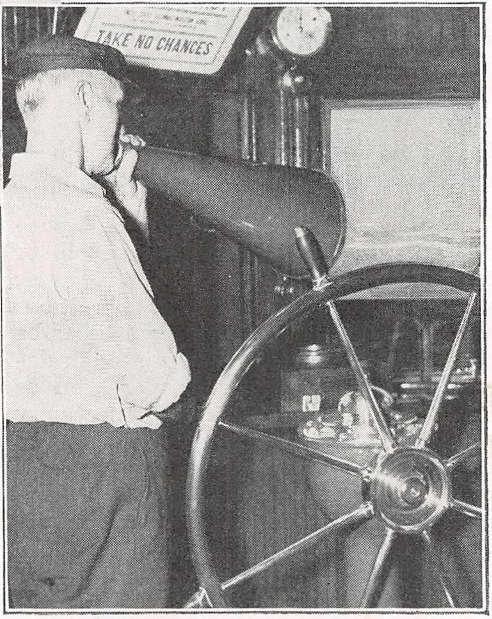
"Erie Basin."

"O.K. Hitch her on."

The tug passed under her bow as the mate caught her heaving line. After the line came a three-inch hawser. They made it fast and took her safely in tow. It was luck that sent that tug across the path of that tramp. Instead of returning from Great Egg Harbor empty-handed, it had picked up a tow that would net the company a neat profit.

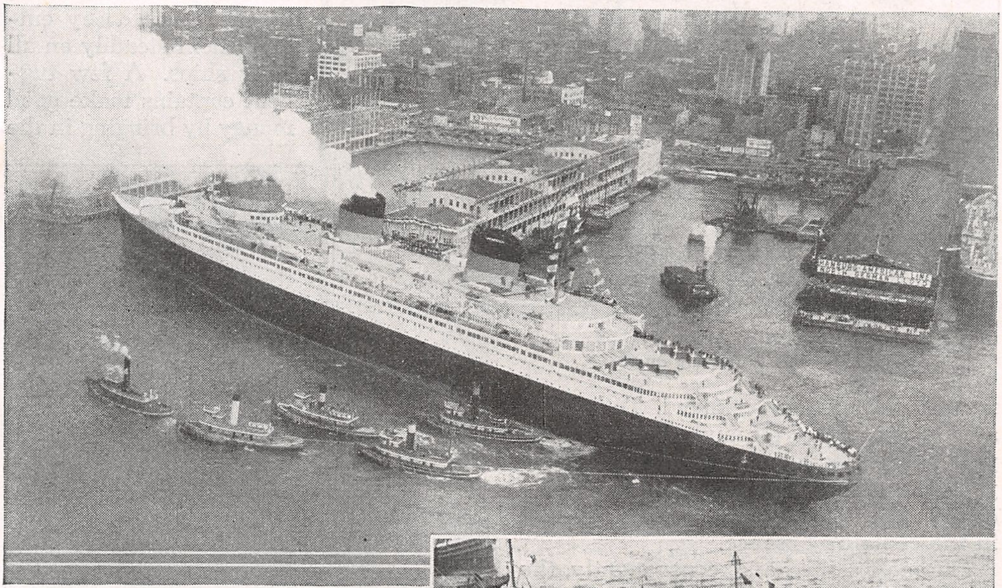
Surprises are part of the adventure on a tug that works around the world's busiest harbor. Some tugs operate on a twenty-four-hour schedule. The crew stands six-hour watches. The volume of shipping has increased greatly of late, and the demand for tugs is in proportion.

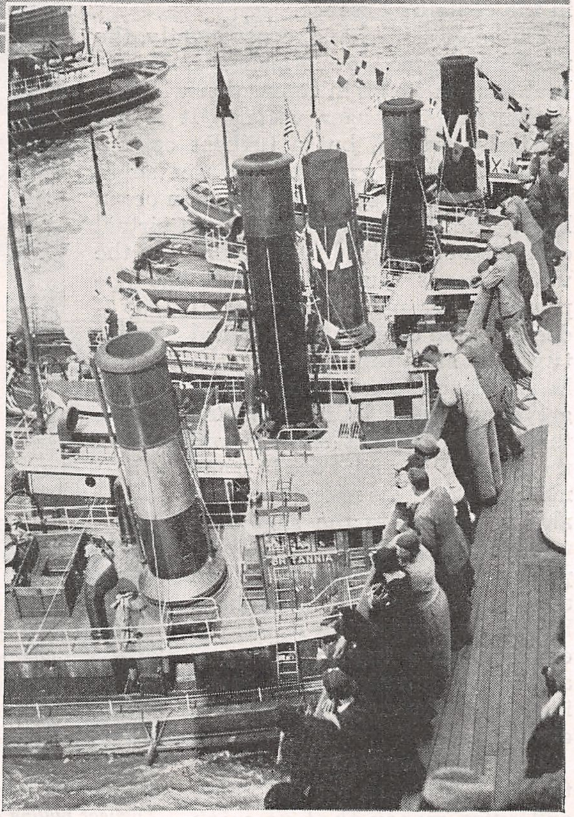
About 350 tugs are necessary to fill the demand for heavy labor around New York harbor. Shipping is never at a standstill. Cargoes must be kept moving to keep down expenses. And the tugboat company that succeeds in doing this is the one that gives the best



Member of tugboat crew throwing line to steamer preparatory to a tow job. Below, tugboat captain giving orders through megaphone

DEVIL FLEET



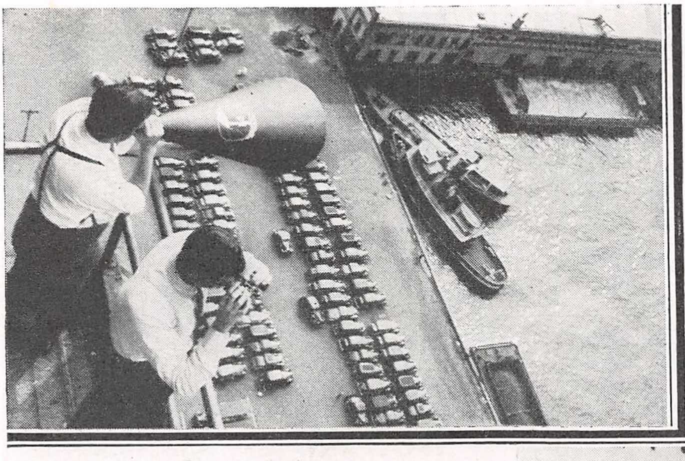


service. Perfect service in rain, fog, and snow, in ice-bound harbors and on stormy nights is a requirement. The tugboat skippers can go where no other seagoing craft would dare. In the dead of night you will see them creeping through shallow and narrow channels, inlets and rivers. The New York harbor shoreline stretches for hundreds of miles, but the tugboat skippers know every part of it.

Up in the pilot house you get a clear view on all sides, but the skipper keeps his eye peeled for all possible comers. Dozens of ferry boats, scows, tramps, barges, lighters and pleasure craft continually cross his path. The best testimony of his skill is the fact that a harbor collision involving a tugboat is rare. The Moran Towing company, operating a fleet of twenty-five tugs, has a ten-year record without a serious collision.

On a day tug which runs only ten hours a day, there is a crew of seven, consisting of a captain, mate and engineer—all licensed; two

Giant liners like the "Normandie," above, and the "Queen Mary," below, tax the skill of the tugs

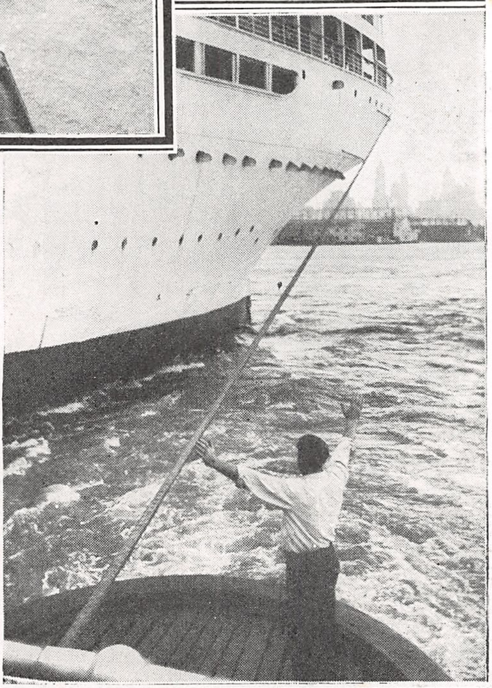


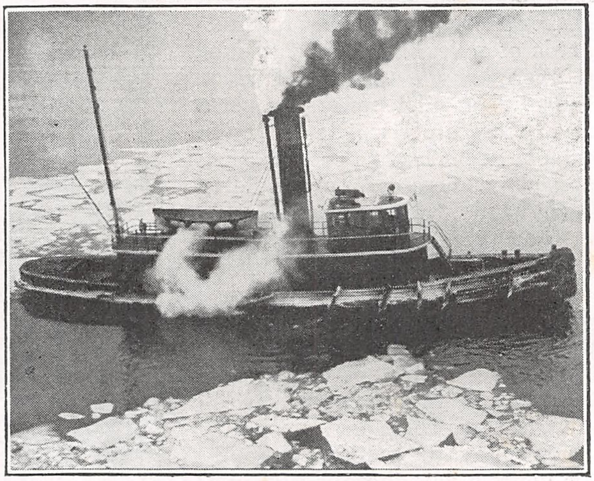
Tugboat dispatcher giving orders through megaphone to crew of waiting boats

firemen, a cook and deckhand. To become a tugboat captain you must serve a three-year apprenticeship as a deckhand. Then you take an examination for a pilot's license, which enables you to pilot the boat in the captain's absence.

The most skilled and, consequently, the most highly paid performance of a tugboat captain comes in connection with the docking of passenger vessels. It is not generally known, but a tugboat captain almost invariably stands on the ship's bridge and directs the docking of an ocean liner. The Sandy Hook pilot is in virtual command of the bridge from the time the vessel leaves quarantine until she approaches her pier. The actual docking is in charge of a seasoned tugboat skipper, who has the knack of squeezing an oversize greyhound into a tight berth. Although the tugboat skipper and the Sandy Hook pilot are in command at the times noted, they are always subject to the ship captain's orders. There is another point not generally known. When a tugboat skipper steps on a ship's bridge, he temporarily leaves the employ of the tugboat company and for the duration of the docking he is in the employ of the ship company.

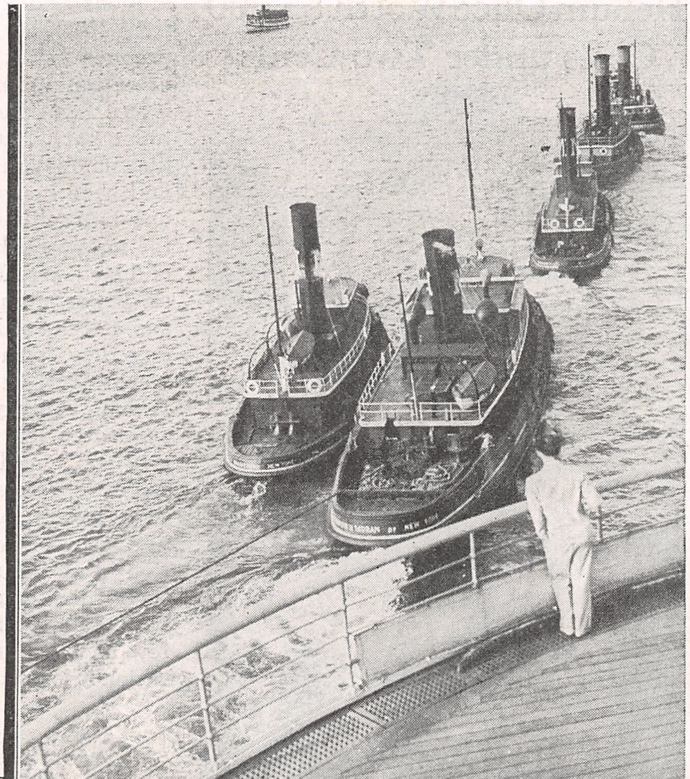
There is live competition among tugboat skippers for the honor and extra money that go with standing on a ship's bridge and supervising the docking. The ship operators have their favorites; they select certain men for the delicate operation of docking, and they employ them steadily on all their ships. A few tugboat captains make good money by bringing in the

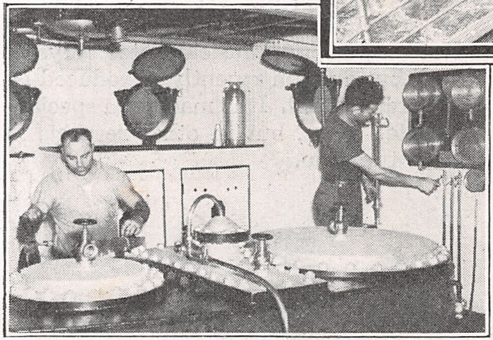


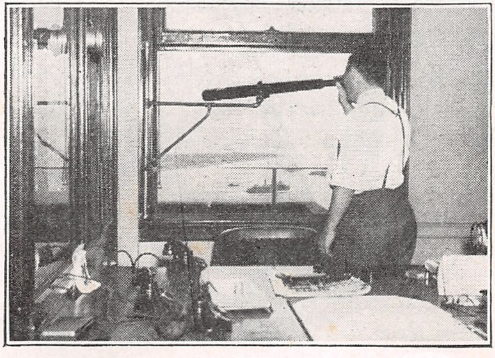


Tugboat pulling at a passenger vessel and, below, tug cutting through ice in New York harbor in order to reach a boat preparing to dock "big ones." They receive from $10 to $25 extra for an operation that rarely lasts more than an hour.

When a tugboat skipper goes aboard a big passenger vessel he spruces up a bit. He pulls down his shirt sleeves, puts on his coat, collar, and tie and dons a natty tweed cap. He resembles one of those clear-headed Sandy Hook pilots. For thirty minutes or more he is the master of a giant sea-going vessel, and if you don't think that is an honor, just listen to the old seadogs around the harbor. When you can dock a vessel like the "Normandie," the "Queen Mary," or the "Rex," everybody salutes you with a pleasant "good morning" from the captain to the mess boy.







Tugs pulling "Normandie's" stern, engine room of tug and tugboat dispatcher watching crew at work

The new big ones present great problems in docking. You never realize what colossal tonnage the "Normandie" and "Queen Mary" have until you stand in the pilot house of a tug and feel the shock of a mild collision travel through it. Suppose you ram the bow of the "Queen Mary" at about three knots, under the power of a 500-horsepower engine. Of course, you strike with your fender of matted rope, but this blow has about as much effect on that giant hulk as a grasshopper would have in colliding with an automobile.

In a strong tide and wind, a dozen tugs come to the aid of a 1,000-foot greyhound. Six gather around the bow and six around the stern. The vessel assists with all her propellers as one tugboat captain stands on the ship's bridge and directs the delicate maneuver of turning in the tide.

When a four-inch hawser comes sailing down from the skyscraper heights of the "Queen Mary's" bow, you had better watch

(Continued to page 140A)

Helium Once Worth $5,000 Costs under Two Cents

© Harris and Ewing

Inflating this balloon with helium would have cost $5,000 in 1916 when the gas was extracted from air

Twenty years ago it would have cost you $5,000 to buy enough helium gas to inflate a small balloon about two and one-half feet in diameter. Today the same amount of gas can be had for one and one-half cents. The drastic reduction in the price of helium since 1916 is due to the discovery by the U. S. Bureau of Mines of a method of recovering helium from natural gas instead of from the air.

Chemist Helps All by Turning Waste into Useful Goods

One of the most important services which the chemist performs is the conversion of surplus and waste materials into useful goods. The chemist is the link binding the farm to the city through the factory, turning the farmer's surplus products and what formerly was regarded as waste into synthetic products worth millions of dollars. The cotton crop taken from 100,000 acres goes into the factory to produce a substitute for leather. The yield of cotton linters from two million acres issues from the factories in the form of toilet ware, fountain pens, motion-picture film, smokeless powder, rayon, safety glass and shoe heels. The yield from one and one-half million acres of corn land is used for making solvents for paints, varnishes and lacquers. In all this the chemist plays an important part. Less than fifty years ago cotton seeds were a nuisance, but today they form the basis for an industry worth nearly a quarter of a billion dollars. A half century ago coal tar, the sticky substance left after the manufacture of coal gas, could not be disposed of by the gas maker, except when small boys burned it in Fourth of July barrels. Today the derivatives of coal tar find useful application in an industry whose value is amazingly high. High explosives, aspirin, carbolic acid, perfumes and dyes are just a few of the things in the manufacture of which it is used.

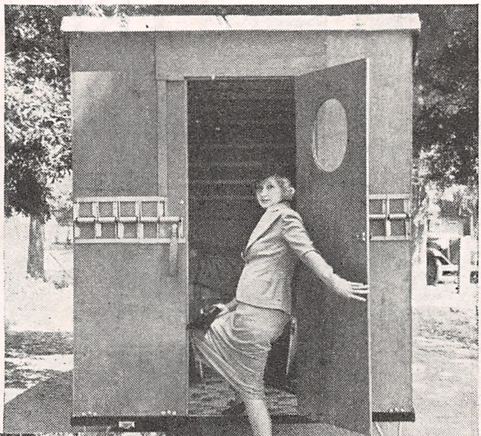
Violin Fashioned of Glass Has Clear Tones

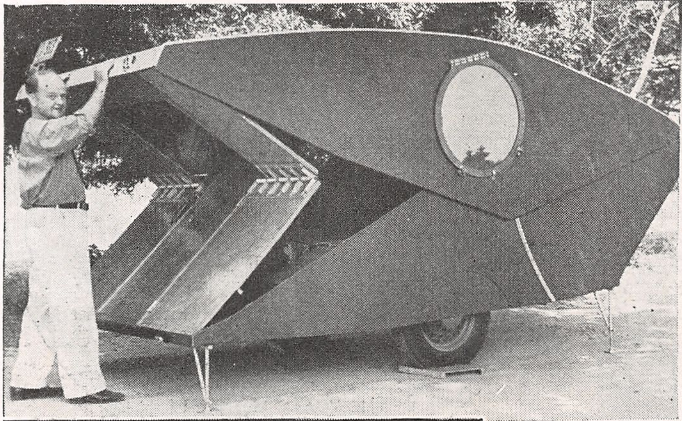
Not only are its musical notes "crystal clear," but a violin recently introduced is, itself, transparent. It is made of a specially treated glass, but in other respects is true to tradition.

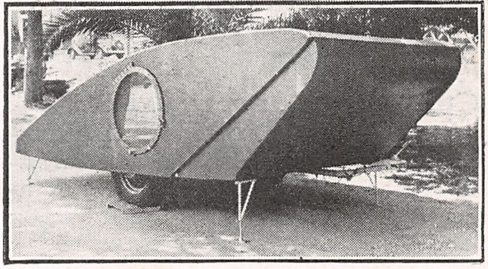
Delicately fashioned of specially treated glass, this violin produces remarkably clear musical tones

Folding House Becomes a Streamline Trailer

For the motoring tourist who wants to carry his home along but wants no bulky trailer blocking his rear vision from the driver's seat, a folding trailer has been developed. When collapsed for driving, it is streamlined to a point at the rear and is below the rear window of the car. Yet when open it is spacious enough for comfortable living quarters, accommodating a double bed and two single beds, stove, sink, refrigerator, water tank, drawers and cabinets. It is six feet two inches wide and thirteen feet four inches long. The single bed supports, when not used for sleeping, form service tables or comfortable side seats. During the day the double bed is latched to the top, out of the way. Springs set in the door frame counterbalance the weight and allow easy opening and closing of the trailer. Four folding legs adjustable for uneven ground make it steady wherever it is parked.







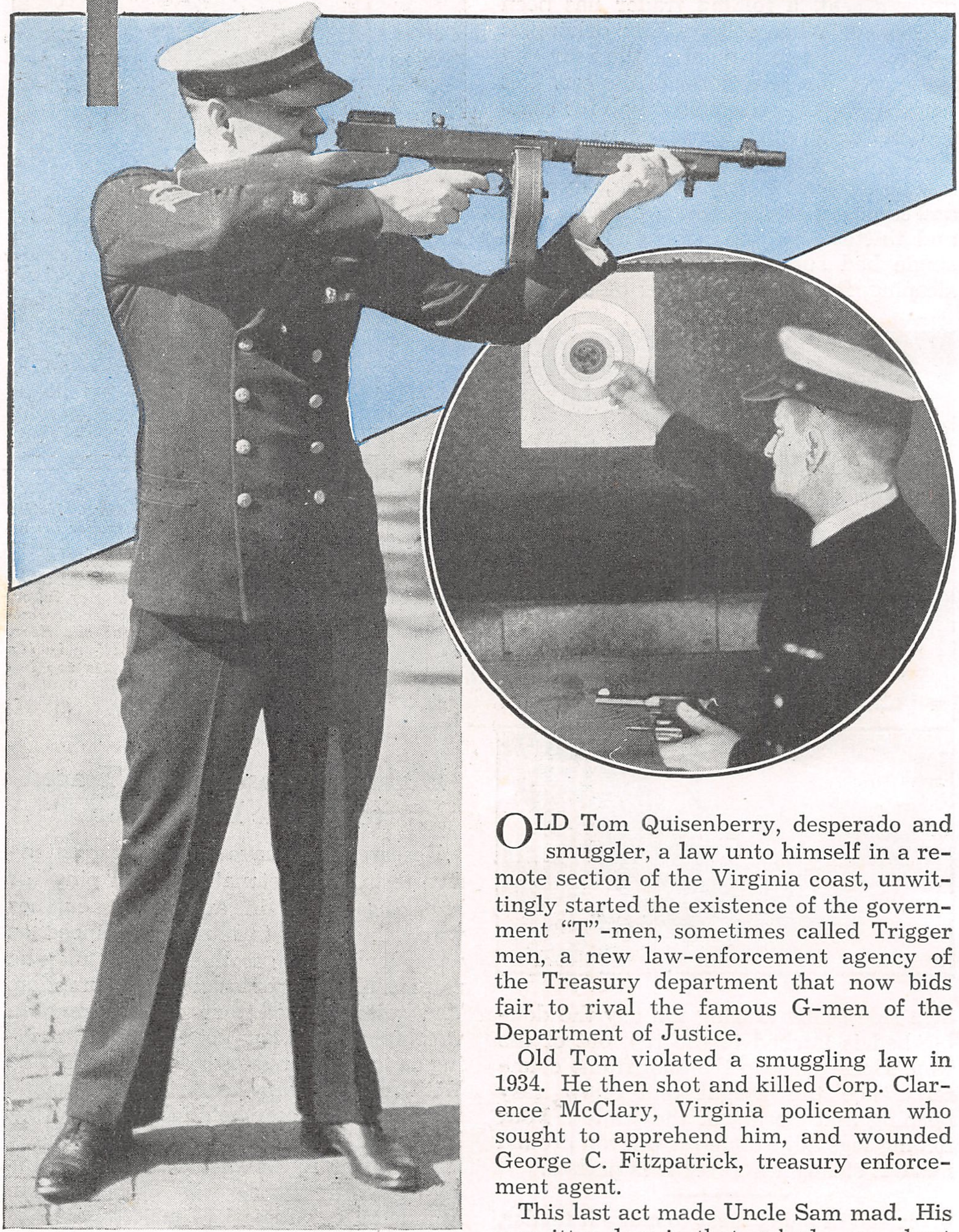
Top, ready for camp. Notice how roomy the trailer is; no need for stooping. Center, folding up for travel. Springs act as a counterbalance making it easy to raise or lower, and corner supports are adjustable to level the floor. Below, the trailer in its streamline form, its top below the automobile window

¶Instead of aging meat to make it tender, a process of "tendering" in one to five days by pumping enzymes through the arteries has been patented.

High Oil Consumption Traced to Engine Detonation

Research men have found, after extensive tests, that detonation, that "ping" or knocking sound in automobile engines when the spark is too far advanced or when low-grade gasoline is used, may be responsible for increased oil consumption. The tests showed that oil consumption was higher with low-octane fuel, increasing as the test engines continued running. With fuels of forty to forty-eight octane rating, consumption held fairly steady, but below that the engine used oil unusually fast. It was found that consumption increased with the severity of detonation. Engineers say motorists may be able to prevent abnormal oil consumption by using factory-recommended gasoline and by having the spark adjusted properly.

T-(TRIGGER) MEN



Trigger man demonstrating use of sub-machine gun and, in circle, a target tells the story of expert marksmanship

OLD Tom Quisenberry, desperado and smuggler, a law unto himself in a remote section of the Virginia coast, unwittingly started the existence of the government "T"-men, sometimes called Trigger men, a new law-enforcement agency of the Treasury department that now bids fair to rival the famous G-men of the Department of Justice.

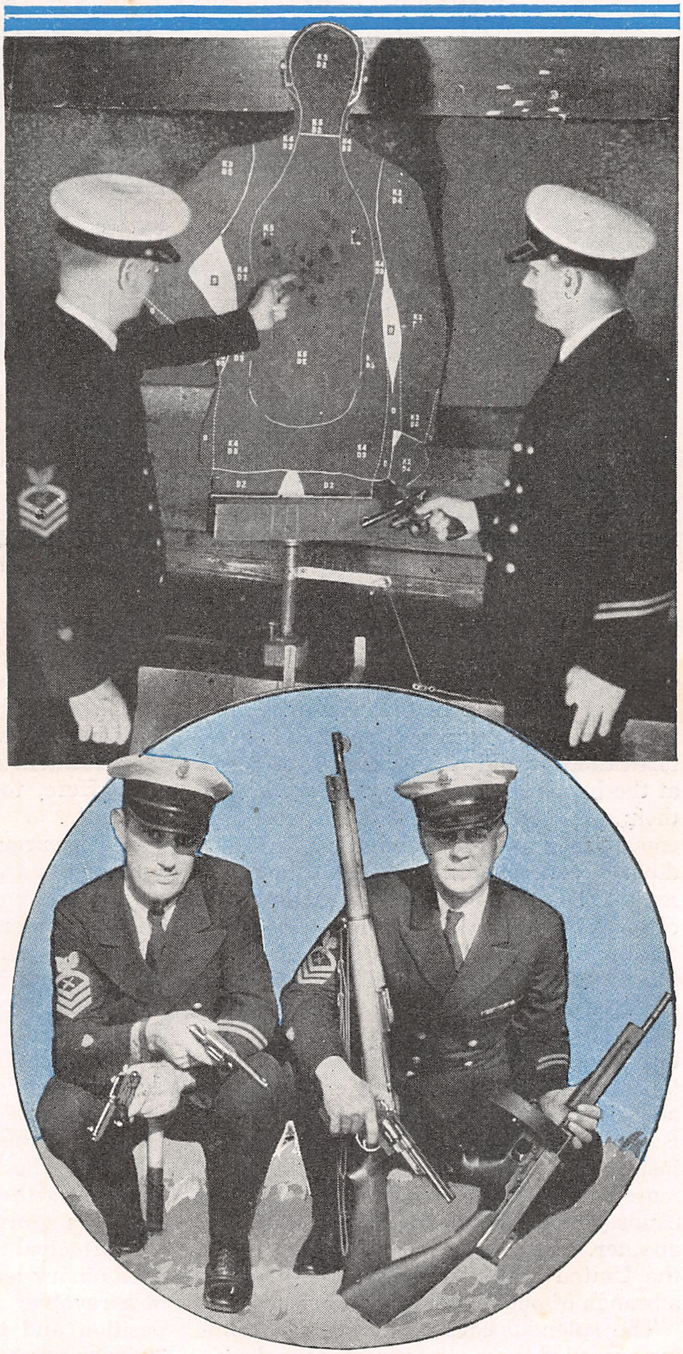
Old Tom violated a smuggling law in 1934. He then shot and killed Corp. Clarence McClary, Virginia policeman who sought to apprehend him, and wounded George C. Fitzpatrick, treasury enforcement agent.

This last act made Uncle Sam mad. His unwritten law is that nobody can shoot one of his officers and get away with it. So the Treasury department went after

of the TREASURY

Old Tom with a vengeance. It called out the coast guard, armed them with an airplane and machine gun, marshalled a formidable army of other law-enforcement officers and rushed them after Tom who had a hideout in an out-of-the-way part of the shore. Old Tom finally was nabbed. This man hunt, seemingly insignificant in itself, revealed to treasury officials the tremendous advantages to be realized from effective coordination of their various law-enforcement agencies. Why not weld them all into a single compact unit, reasoned the treasury secretary?

For years all branches of the federal police under the direction of the treasury department had gone their own various ways in the matter of firearms training. There hadn't been much attempt at standardization. Men owned their own guns, bought their own ammunition and did their shooting in accordance with their own ideas. Today's situation is entirely different. All the treasury undercover agents have been grouped into the "T-men," or Trigger men, a cohesive organization under the direct thumb of Secretary Morgenthau. Every one of them is a marksman, if not an expert, with revolver, pistol, rifle and



Silhouette of upper part of man's body used as target for Trigger Men and, below, some of the weapons of the treasury man and two guards who know how to use them

Chief Gunner H. B. Rodman of Coast Guard instructing a treasury guard in the loading and care of his revolver. One of the points stressed is safety

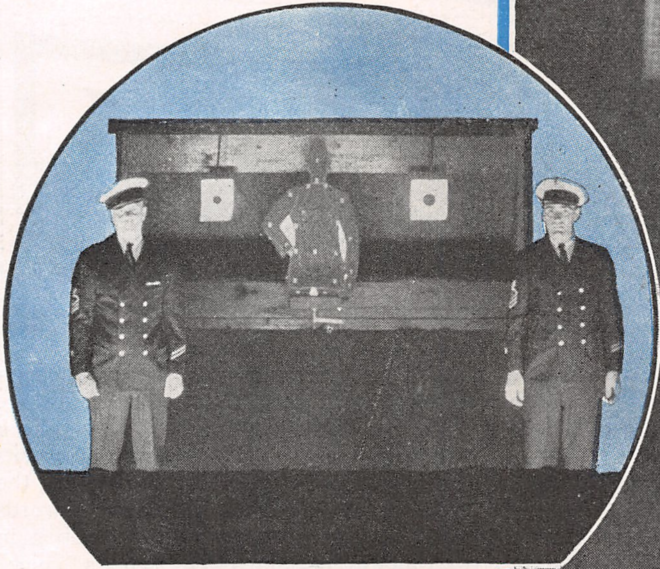
machine gun. In inaugurating his new organization, the treasury head first decided upon a more efficient method of training his men in the use of firearms than previously was in existence, so that henceforth there would be less danger of death at the hands of those who take the law in their own hands. And if there were not enough men to do the job in the particular division concerned, there should be a reserve corps that could be called in cases of special emergency.

Thus arose the T-men. They compose the personnel of eight different units of the treasury department; secret service, White House police, customs, alcohol tax unit, guards of the mints and assay offices, treasury guards and bureau of engraving and printing guards. And to this list may be added the guards of the federal deposit insurance corporation. All in all there are more than 5,700 T-men. They range the country over, some in one city, some in another. They go by districts throughout the United States, wherever there exists a branch of one of the above agencies.

The splendid course of firearms training accorded these men is under the direction of the coast guard. Chief supervisor is Commander J. E. Stika, with headquarters in Washington. The nation's capital city has perhaps the largest single group of this far-flung personnel. Here is located the treasury department, with its millions in gold, silver and currency; here is the President's residence and office quarters. Here, too, a branch of the alcohol tax unit.

The firearms training given the members of the treasury personnel in Washington is representative of the training given members scattered throughout the United States. In Washington are three target ranges for small arms. These ranges are fifteen yards each with a brick wall for a backstop. In front of this brick wall is a steel plate set at an angle of forty-five degrees, top out. This deflects the bullets fired into a bed of sand three feet deep at the base of the target.

Before the trainees are permitted to start firing they receive instruction in the use of a gun from coast guard experts. The principal things touched upon in these preliminary lectures are safety in the use of a revolver and pistol, sighting, aiming, position and trigger squeeze. The term, "trigger squeeze," may confuse the novice. The T-men never pull a trigger. What they do is "squeeze" it. The revolver or pistol is gripped firmly in the hand at the moment of fire and "squeezed" with pressure applied to the trigger. This makes for steadiness and accuracy. The natural movement of a revolver held at arm's length is one of wavering indecision. First it is on the target, then it is off. It points above or it points down. But at some time or other during this wavering the weapon is directly on the target. The main idea is to hold the revolver there steadily for that fraction of a second while the trigger is being released. With the gun held firmly in the hand, the side braced by the thumb, and the trigger squeezed instead of pulled, accuracy of fire is at its highest point of efficiency. Aiming, position, sighting, may all be important, and the trainee be well nigh perfect in their application. But unless he knows how to release the trigger, he may never qualify as a marksman.



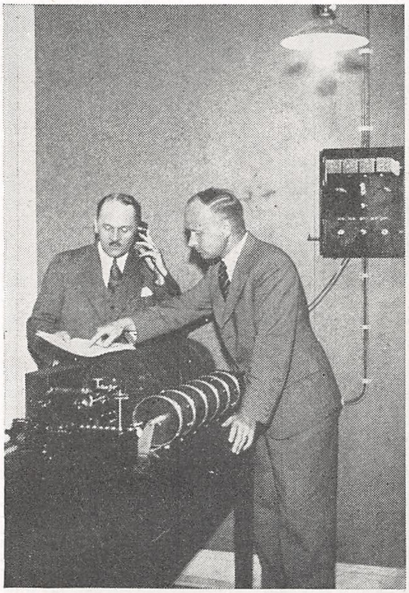
Dummy target used on rifle range and, at right, drawing bead with high-powered rifle

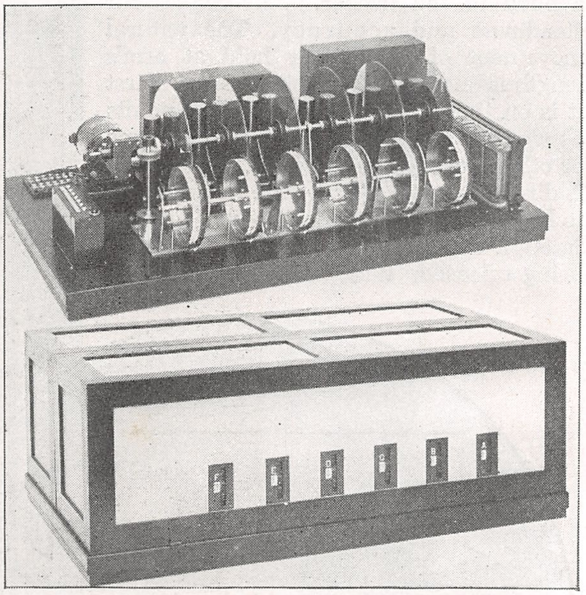
Training is first given with .22 caliber revolvers and pistols. The men stand at ten yards and fire ten shots, slow fire. The size of the whole target is eight and three-fourths inches. It is divided into seven circles, starting with the black "eye" in the center. This eye, one and one-eighth inches across, has a value of ten points when pierced. The others range down from nine, eight, seven, six, five, four.

To qualify at slow fire the trainee must make a score of seventy per cent or better, 140 points out of a possible score of 200. As soon as the trainee becomes proficient at slow fire, he is given the problem of time fire. This requires two strings of five shots per string, twenty seconds being allowed for each string. This means the trainee must fire a shot every four seconds. Qualifying in this is the same as slow fire. Then the target is moved back five yards and the whole procedure is gone through again. The trainee must pick up his .22 and repeat his ability to place his shots with accuracy in the target for a qualifying score. In the meantime the score has been pushed up. Instead of

(Continued to page 138A)

Phone Robot Gives Weather at Turn of Dial



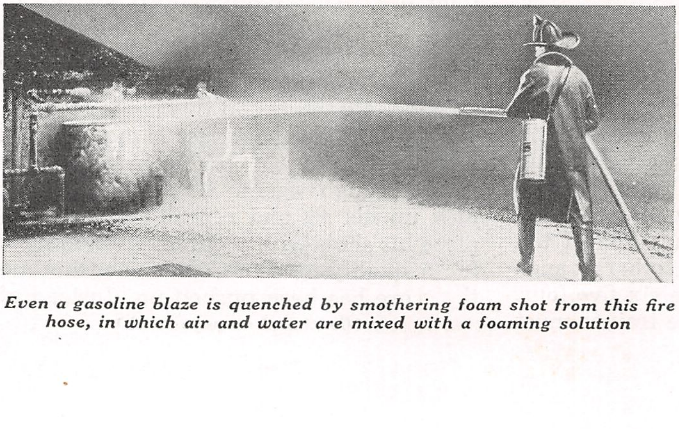


Weather bureau officials setting telephone robot to give forecast. Right, two views of the machine which "talks" to subscriber asking about the weather. Bottom view shows cabinet which houses the machine

By dialing a certain number in Stockholm, the telephone subscriber sets in motion automatic equipment which gives him a twelve-second forecast of the weather for the day. The robot consists of a cabinet housing six drums, adjustable and numbered from one to twenty. Each of the 120 numbers represents a word used in the official forecasts of the weather bureau. The words are photographically recorded on film disks in the form of 120 concentric rings, with twenty photographic channels on each disk. Adjustments are made five times each day. Every time a subscriber rings, the transparent disks spin, an electric eye casts its beam on the recording grooves and picks out the words which are relayed to the subscriber in well modulated tones. The robot's "voice" is that of Signhild Bjorkman, actress, who cooperated with the weather bureau in making the word disks.

Water Converted into Foam Smothers Gasoline Flames

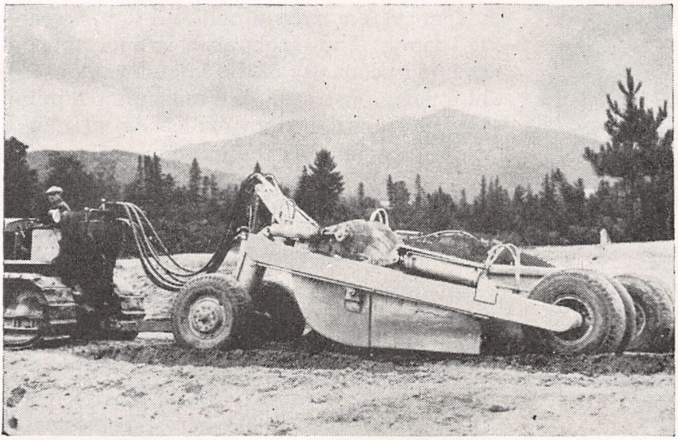
Ordinarily, water thrown on blazing gasoline, oil or paint merely helps spread the blaze. But water converted into foam by a recently developed extinguisher quickly smothers the flames by floating on the burning liquid and blanketing the burning solid. Both effective and economical because it mixes the foam mechanically instead of chemically, this extinguisher forces air, water and a special solution into a pipe where it becomes foam. Only twenty gallons of water



Even a gasoline blaze is quenched by smothering foam shot from this fire hose, in which air and water are mixed with a foaming solution per minute are necessary, and a minimum pressure of seventy-five pounds is required. When the foam-forming solution is not connected, the hose shoots a stream of water.

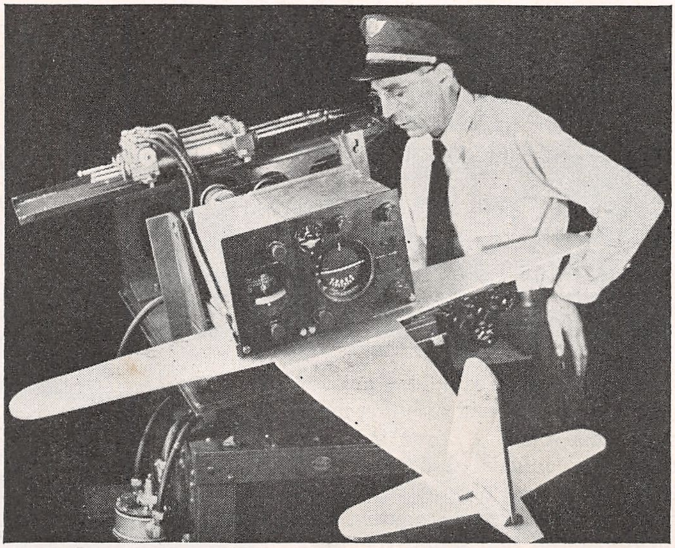
Hydraulic Robot Speeds Work on Excavations

Designed to work in any kind of soil, a giant machine operated by hydraulic power digs and loads, lifts and hauls, dumps and spreads automatically on road work or excavations. Towed by suitable tractor, the machine can dig, haul and spread 500 to 1,000 yards of dirt in an eight-hour day, depending upon the size of the scraper used. In many cases, the machine has been operated continuously for twelve to twenty hours in sand, clay, loam or rock. The tractor driver applies power by means of cables connected to the "robot." The power may be applied where required and in any direction.



Road-working robot in action. Note hydraulic hose connections to tractor, permitting driver to apply power where needed in the machine

Automatic Pilot for Sky Liner Is Given Severe Reaction Test

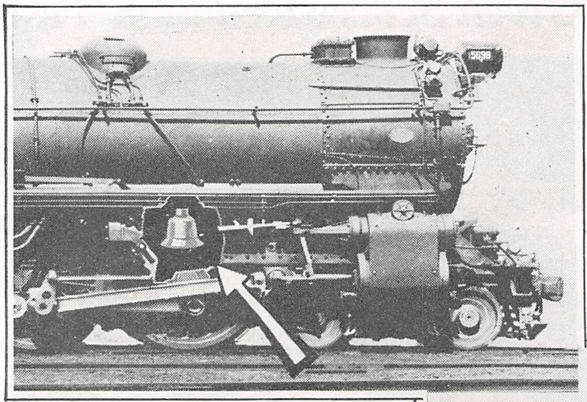


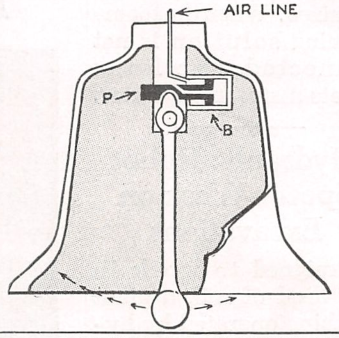
Before taking over controls of a transport plane, the automatic pilot is "taken for a ride" on a tester that simulates motions of flight

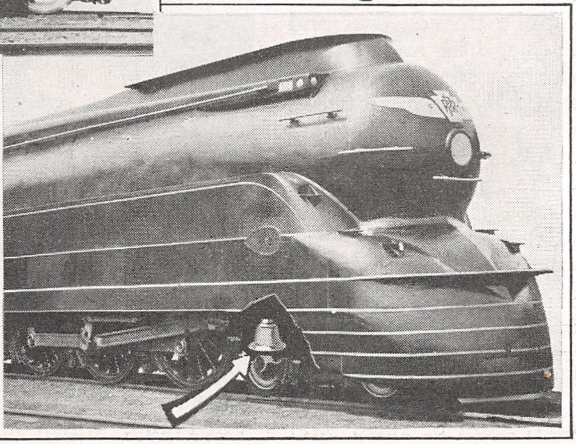
Just as the human pilots of air transports must undergo thorough tests of their skill, the automatic pilot too must prove its ability in a severe instrument test. Before this "third pilot," which enables a plane to fly a straight course and corrects any deviation from the intended path of flight, is installed on the sky liner it is put to a two-hour test on a master machine. This laboratory tester can simulate all the motions of yaw, pitch and turn encountered in actual flight, subjecting the automatic pilot to more severe conditions than would occur in real service. The pilot being tested records its reactionary force exerted to counteract the movements. Vacuum drives the gyroscope within the control units, and the unit applying control direct to the plane controls is actuated by 125 pounds pressure applied by a motor-driven oil pump.

¶ Whenever you find that you wish to know more about any article described in this magazine, write our Bureau of Information, inclosing return postage.

Bell Hidden under Train Is 'Blown,' Not Rung







Bells on modern locomotives are "blown" instead of being rung and those on the latest streamliners are concealed beneath the locomotive. An air-driven piston swings the clapper against the inside of the bell when the fireman opens a hand valve. Streamlining brought the problem of where the bell should be located. This problem was solved by moving the bell from its place on top of the locomotive to the frame beneath, where it can be heard distinctly but cannot be seen.

Two cutaway views of latest locomotives showing where bell is now located. Right, top, cross-section of air-driven bell

Human Body Sets Off Alarm on Model of Bank Vault

Passing hand near model of vault alarm system causes bell to ring

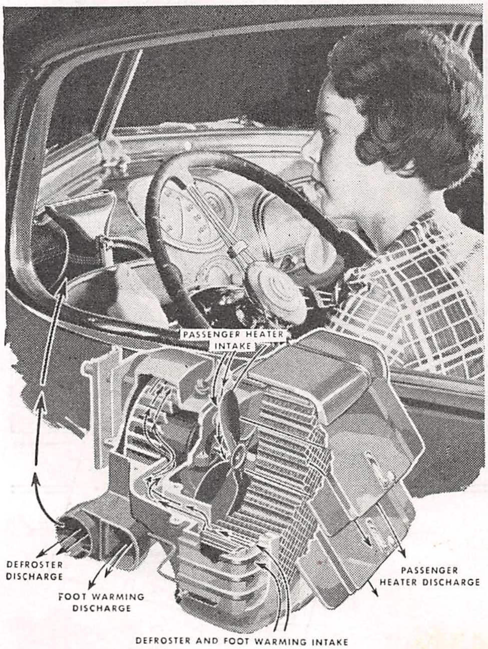
When someone approaches near enough to handle the lock on a bank vault, a new alarm system rings a bell and lights a signal lamp. The mechanism is operated by the body capacity of the intruder. A model for demonstrating the alarm has a miniature signal system which is actuated merely by passing the hand near the lock.

Giant Floodlighting System Speeds Work on Fair

In order that the contractor may complete his job of preparing the site for the 1939 world's fair in New York, a giant floodlighting system has been installed for night work. The installation, designed to light more than 1,000 acres, consists of 345 units, each using a 1,500-watt lamp. In addition to the general lighting units, each drive-line machine and shovel has its own lighting equipment to provide illumination on excavations. The contractor has the task of removing and refilling seven to eight million cubic yards of material to create a level area before expiration of the contract on April 1, 1937. This means that thirty cubic yards must be handled each minute of the day and night.

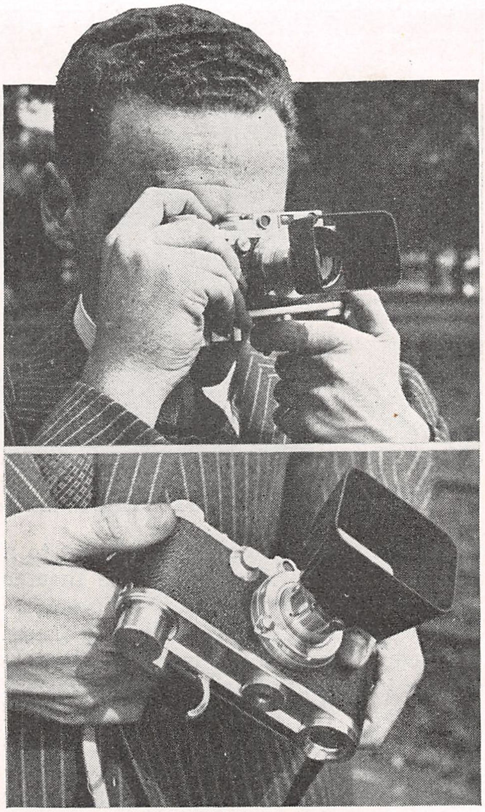
Car Heater and Defroster Warms Driver's Feet

Designed to warm the car, keep the driver's feet comfortable and defrost the windshield, the latest auto heater has controlled outlets for serving each purpose. A defroster attachment may be installed on the instrument panel or on the inner side of the left-hand locker door, if the car has one, to direct the warm air against the windshield. A hose beneath the cowl connects the heater with the defroster outlet. A propeller fan forces air through the large radiator core for general car heating while another fan sucks air through openings on the edges of the core and delivers heat through separate ducts to the defroster and foot warmer.



Top, defrosting unit of heater. Bottom, cutaway view of combination heater

Trigger for Small Camera Snaps Twice per Second

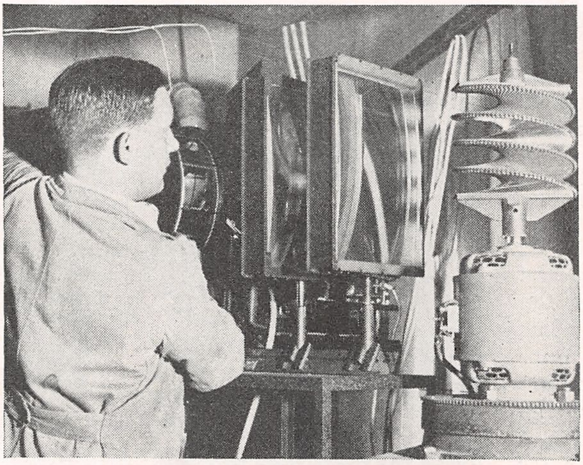


Position for taking fast sequence pictures, and view of rapid-winding trigger on miniature camera

By attaching a special base plate incorporating a rapid winding device, a miniature camera of the "candid" type can take as many as thirty-six or more still pictures in twenty seconds. Thus the photographer can snap a group of pictures in sequence depicting an entire episode of action covering several seconds. There is a trigger on the rapid winder, and as the finger pulls it along a groove the shutter is wound and the film moved into position for another immediate exposure. The speed of the sequence pictures is limited only by the speed of the cameraman in pressing the shutter release button and snapping the winder trigger.

¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

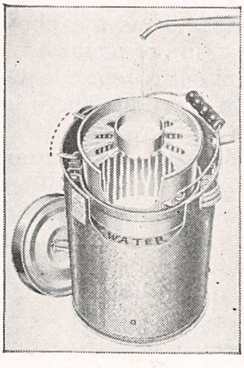
Television Image Enlarged by Revolving Spiral Mirror



Spiral mirror driven by synchronous motor makes it possible to project television picture on large theater screen

Enlargement of television pictures to a size that can be shown to large theater audiences has been achieved by a spiral-mirror contrivance invented by a German engineer. The ordinary image on the television tube is too small to be seen except by those close at hand, but with the aid of the spiral mirror the picture is caught from the tube, thrown through an enlarging camera or system of magnifying lenses and projected to any desired size. The spiral is driven by an electric motor.

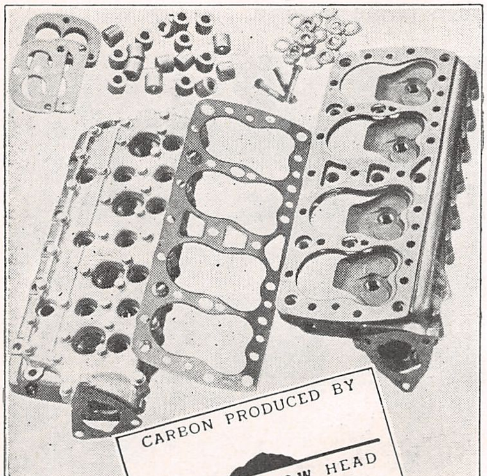
Cream Cooler for Dairy Farm Chills Cream as It Separates



To chill cream as fast as it leaves the separator and thus keep it fresher and purer for the market, a Minnesota farmer has invented a simple cooler. Cold water is placed in a galvanized iron container within which the cream container is set. This is held in the center and off the bottom by bands adjustable with levers. In the top of the cream pail is a spreader which receives the cream falling from the separator spout, and aerates the fluid as it divides into forty-eight fine streams to be cooled as it flows down the cold inner wall of the container.

Copper Alloy Engine Head Boosts Power, Saves Gas

Constructed of a special copper alloy, a new type engine head for the modern automotive engine is claimed by the manufacturer to give more power, save fuel and decrease formation of carbon. Tests by the maker were reported to result in a power gain of twenty-seven per cent and a fuel saving of eighteen per cent. At present the head is available for Ford V-8 engines, certain models of Chris-Craft inboard and Johnson outboard marine motors. Its use on any modern engine is contemplated. The copper head is said to



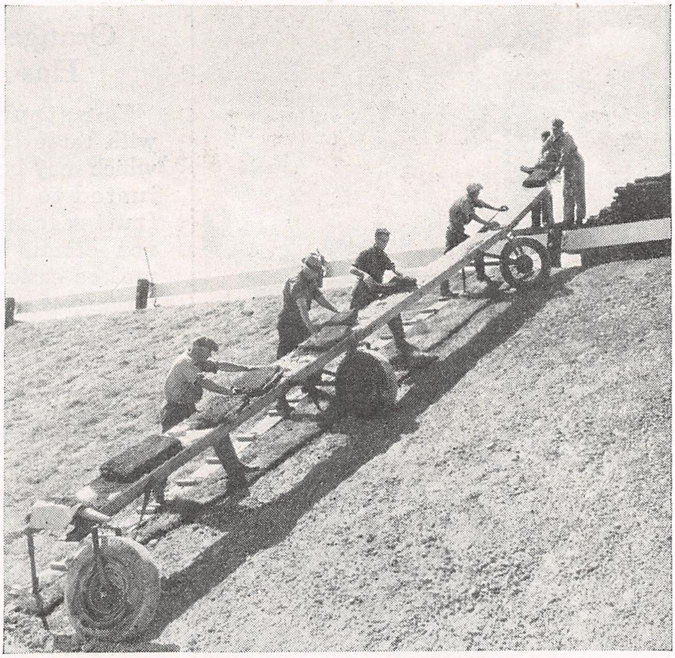
New engine head and, below, illustration of carbon-resisting qualities of head dissipate heat seven times faster than iron and twice as fast as aluminum, making possible higher compression ratios than those in engines which dissipate heat slowly.

Lock Sounds Alarm if Wrong Button Is Pressed

If you push the wrong combination of buttons to release a keyless electric lock recently invented, an alarm bell will ring for seven minutes. The lock is operated by pressing the proper combination of buttons, and these can be changed as often as desired by altering a switchboard inside the house. There are fifty-six possible combinations, and if all combinations were tried before guessing the right one it would take more than six hours. The combination lock operates on low voltage alternating current.

The right combination releases this electric lock; push the wrong button and an alarm rings

Sod Conveyor on Wheels Makes Landscaping Easier

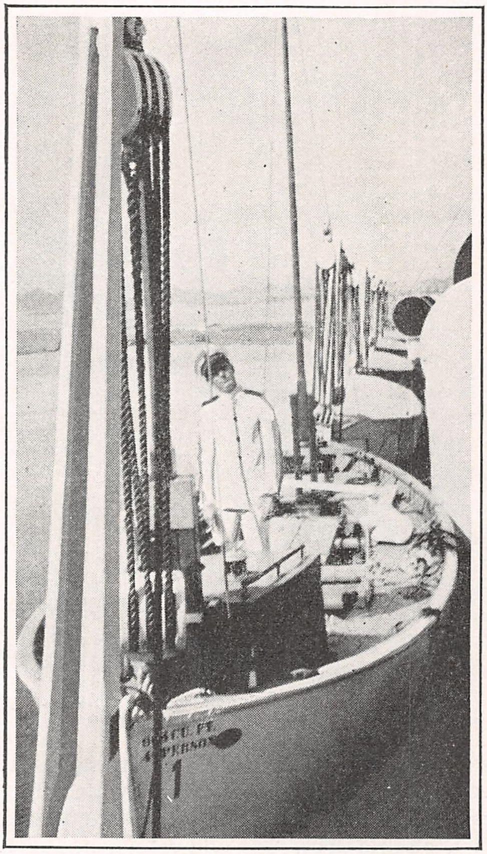


Sodding incline with aid of odd carrier. Note how sod is pushed down table to point where worker removes and lays it on ground

Handling large quantities of sod on hillside or steep fill has been made easy by a conveyor on wheels which may be constructed from reclaimed lumber, iron and automobile wheels and tires. The odd vehicle has been used with success by an Indiana company of landscapers and sodders working on large projects. The top, or table, is constructed of two-inch planking, faced with sheet metal to expedite sliding the sod from top to bottom. Built in sections of fourteen feet each, the conveyor is adaptable to any height fill. It is moved forward on the pneumatic-tired wheels inflated at low pressure. The tires facilitate rolling and do not destroy the fine grade prepared for the sod. A cleated strip fitted to the table with uprights provides a walkway for the sod layers and also a means of moving the conveyor. The laborers simply lift the cleated track and push.

Inquiries as to makers of articles described in Popular Mechanics, will be answered by our Bureau of Information upon receipt of return postage.

Radio Lifeboat with Motor Increases Safety at Sea



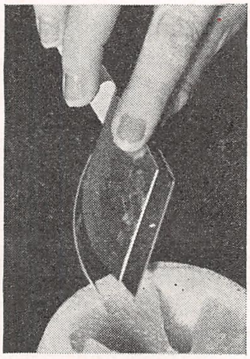
Two-way radio station housed in tiny cabin aboard motorized lifeboat helps guide rescuers

Small but powerful radio transmitters and receivers have been ordered installed in motorized lifeboats with which passenger-carrying ships must be equipped. The radio "stations" are housed in small cabins on the lifeboats. Successful daylight communication with radio stations more than 400 miles away has been attained in recent tests of the radio lifeboat.

'Barking Dog' Automobile Horn Scares Cattle Off the Road

Designed originally as a novelty for motorists, an automobile horn that imitates a barking dog was found to be a real boon to drivers on western roads where cattle become a nuisance on the highway. Ordinarily a steer pays no attention to even the loudest horn, but sound the "barking dog" horn and the cattle waste no time in getting out of the way.

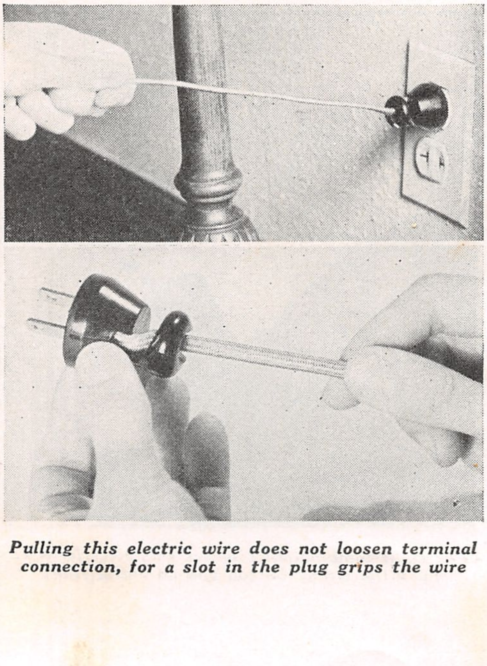
Orange or Grapefruit Knife Has Adjustable Blades



Constructed with three blades which may be adjusted to fit the fruit segments, a new citrus knife makes easier the serving of orange or grapefruit. The curved back blade frees the fruit from the peel and the two side blades release the segment. If the juicy segments are to be used for salads, they may be lifted as they are cut by drawing the knife back slightly and tilting the handle over the peel.

Wall Plug Grips Electric Cord Preventing Loose Connection

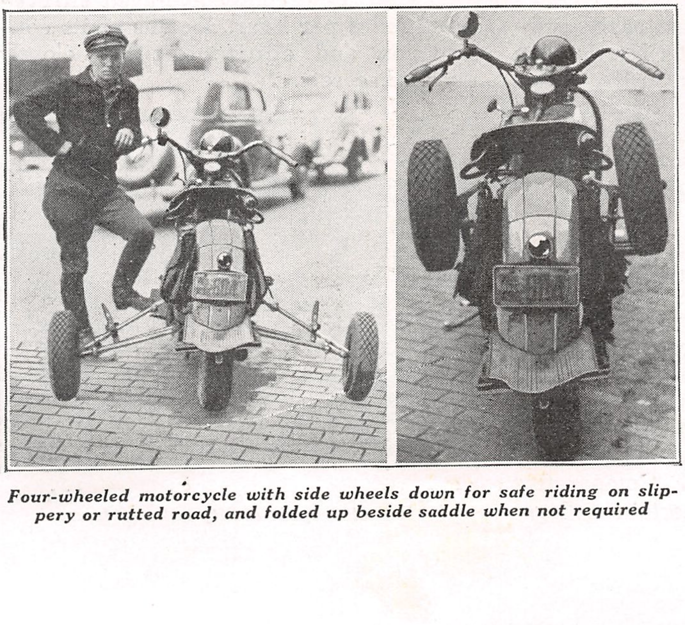
Pulling an electric cord to draw the ordinary wall plug out of its socket is not always safe, for the strain is likely to



Pulling this electric wire does not loosen terminal connection, for a slot in the plug grips the wire loosen the terminal wires in the plug and cause a short circuit. A plug that grips the cord tightly and takes all the strain off the terminal connections is now available. A slot in the finger grip part of the plug forms a twist in the cord so that you can jerk the cord without affecting the contact screws.

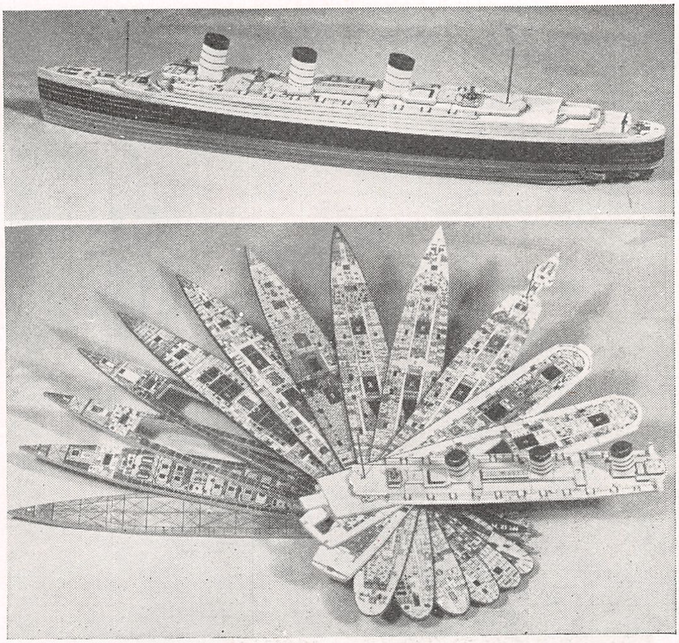
Retractable Wheels Make Motorcycle Safe to Ride

Taking a tip from aeronautics, a Seattle motorcyclist has added a pair of retractable wheels that make riding less hazardous, especially on slippery streets. When the auxiliary wheels are down it is impossible to tip the motorcycle over; when they are not needed they fold up beside the saddle. Airplane landing wheels and tires were used. The motorcyclist has found them useful on country roads and in steadying the machine when necessary to tow it.



Four-wheeled motorcycle with side wheels down for safe riding on slippery or rutted road, and folded up beside saddle when not required

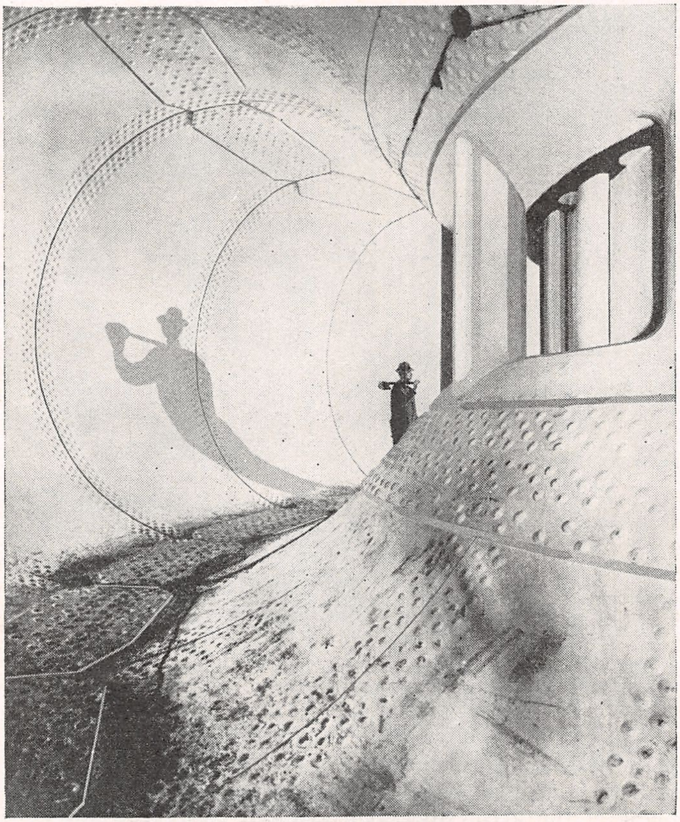
Take-Apart Model Shows Interior of the 'Queen Mary'



Cardboard model of the "Queen Mary," each deck accurately charted in color and supplied with a key to show the layout from funnel to keel

You can look below decks into the heart of the "Queen Mary" and see the layout of the entire vessel on the decks of a take-apart model designed by an artist from official plans of the great liner. On thirteen cardboard cut-outs conforming accurately to the shape of each deck the floor plans are drawn in color, minutely detailed, each part numbered for identification by a printed key supplied with the model. When all the decks are laid one over another in the proper order, topped with the funnels and masts, the cardboard ship is a true scale model of the liner. By removing the three lowest decks the ship is represented as it would appear afloat at sea. Two small brass bolts hold the decks together when they are assembled. The model is about twelve inches long.

Scroll Case Like Big Tunnel Diverts Flow at Norris Dam



Lights cast weird shadows inside this vast tunnel, the scroll case through which Tennessee river water will flow to the Norris Dam turbines

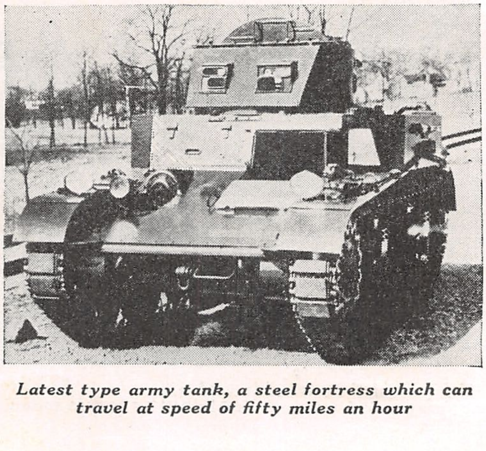
So colossal is the scroll case of the power plant at the government's Norris Dam in Tennessee that workmen in the unfinished tube seem to be traveling through a great circular tunnel. It is through this steel channel that Tennessee river water will be diverted to the turbines to generate power.

Human Race Is Growing Taller as Sons Outstrip Fathers

Apparently the human race is growing taller. Sons and daughters entering colleges in this country are two inches taller and seven pounds heavier than their parents and grandparents when the latter attended the same schools. Comparative measurements taken at certain colleges indicate students on the average have gained about one and one-fourth inches in a generation, thirty-five years. The rate of gain in height for eighty years has been about one centimeter every twelve and one-half years. Male students through fifty years have gained an average of twenty-one hundredth pound each year, and college girls average four pounds heavier than their mothers did. Measurements of army recruits in several European countries similarly indicate men are growing taller.

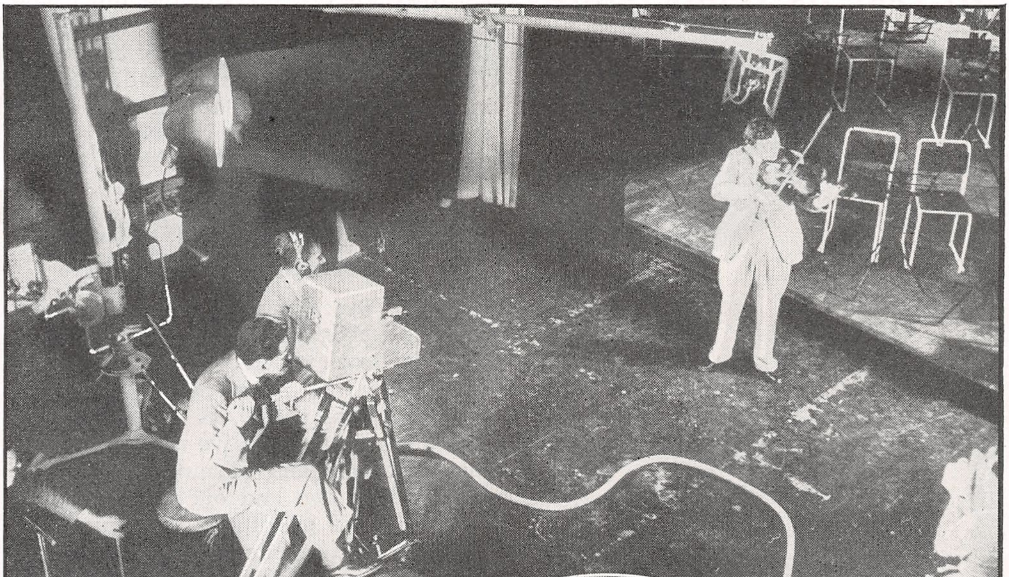
High-Speed Tank Travels at Fifty Miles an Hour

Capable of speeds up to forty and fifty miles per hour, the latest fighting machine to be constructed for the army is a veritable fortress on wheels. On a test run from the Rock Island, Ill., arsenal to Dallas, Tex., the big army tank recently averaged thirty-three miles per hour. Details of its construction and equipment are closely guarded secrets.



Latest type army tank, a steel fortress which can travel at speed of fifty miles an hour

Movie Cameras Film English Television Scene



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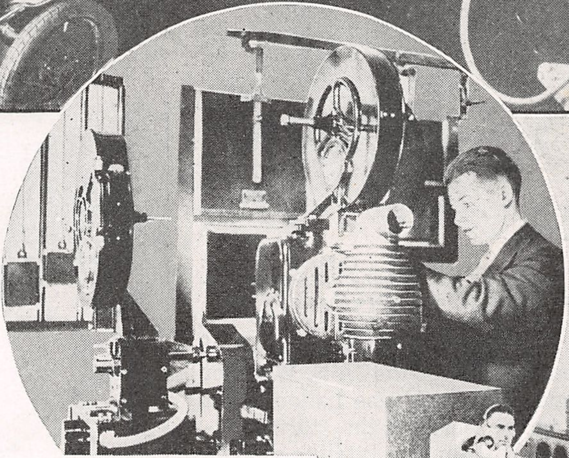
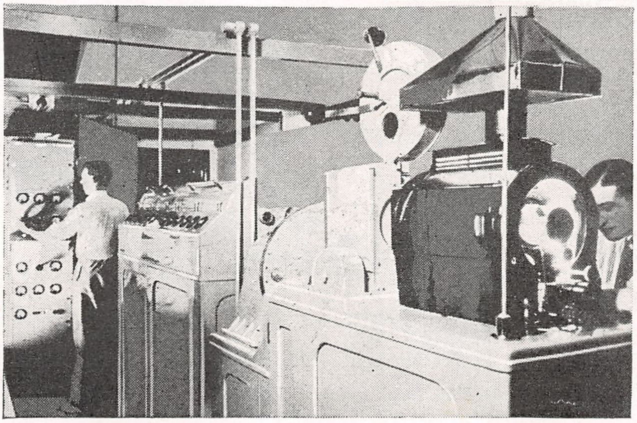
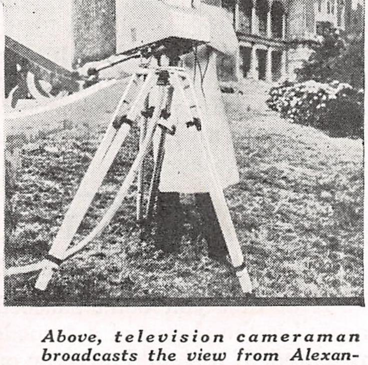
Regular television broadcasting has been started at the Alexandra Palace studio of the Marconi Electrical and Musical Industries at North London, England. Above, two instantaneous television cameras are trained on a violinist, the camera in the right corner waiting to be "faded in" for a picture from a different angle. In the circle, television films are being transmitted with the projector, and below, television scanners and control boards are seen

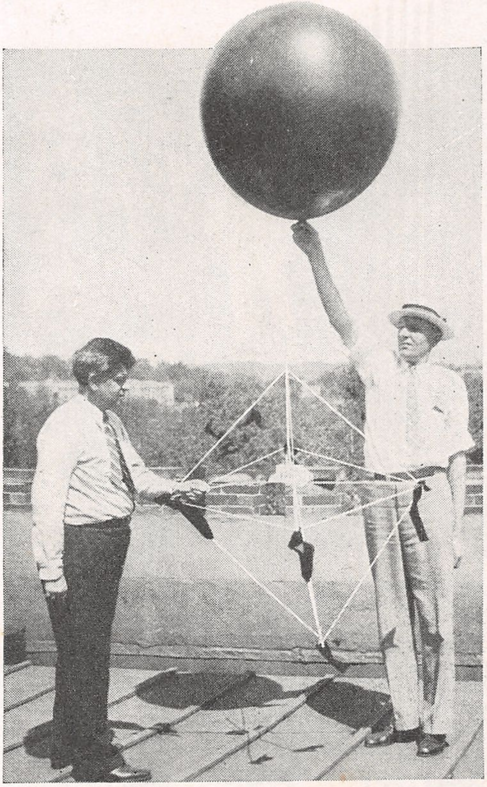






Above, television cameraman broadcasts the view from Alexandra Palace on the heights of North London. In the background is the studio building and its aerial mast

Balloon Rides a Hurricane to Take Its Temperature



© Harris and Ewing

This fragile bamboo "kite" and the delicate instruments it carries weigh little more than an ounce

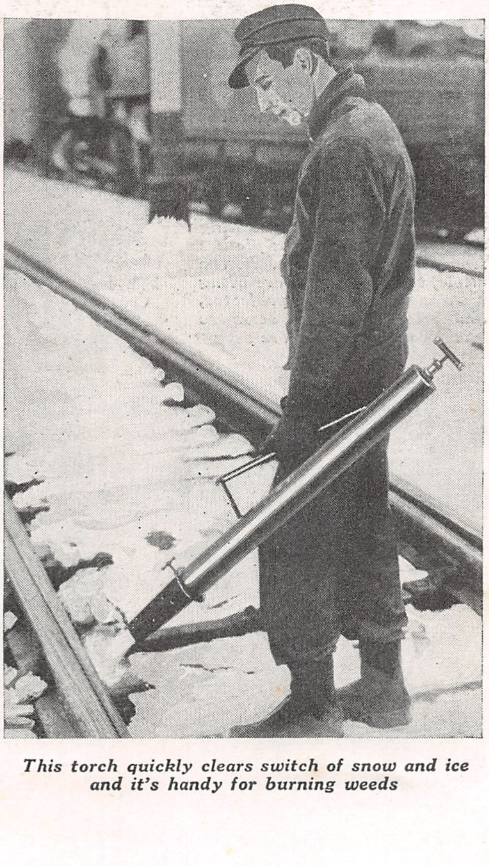
To take the "pulse" and temperature of a hurricane, experts of the U. S. Weather Bureau send up a little gas balloon that goes right to the heart of the storm. Attached to the balloon is a kitelike vehicle of bamboo sticks which, with the instruments it carries, weighs a little more than an ounce. These instruments record the barometric pressure, temperature, and humidity on a bit of smoked glass the size of a postage stamp.

Torpedo Turns for New Attack if First Misses Enemy Ship

"If at first you don't succeed, try, try again" is the slogan of a torpedo recently patented. If it should miss the enemy battleship on the first attempt, this torpedo would turn about and strike from the other side. Its electrical mechanism lies dormant unless the torpedo misses the target; then the proximity of the hull would upset its "magnetic balance" and cause it to turn in a wide circle toward the vessel. The inventor also devised a radio receiving mechanism in the torpedo by which the missile can be maneuvered by radio signals from the projecting ship.

Torch for Thawing Switches Operates on Gasoline

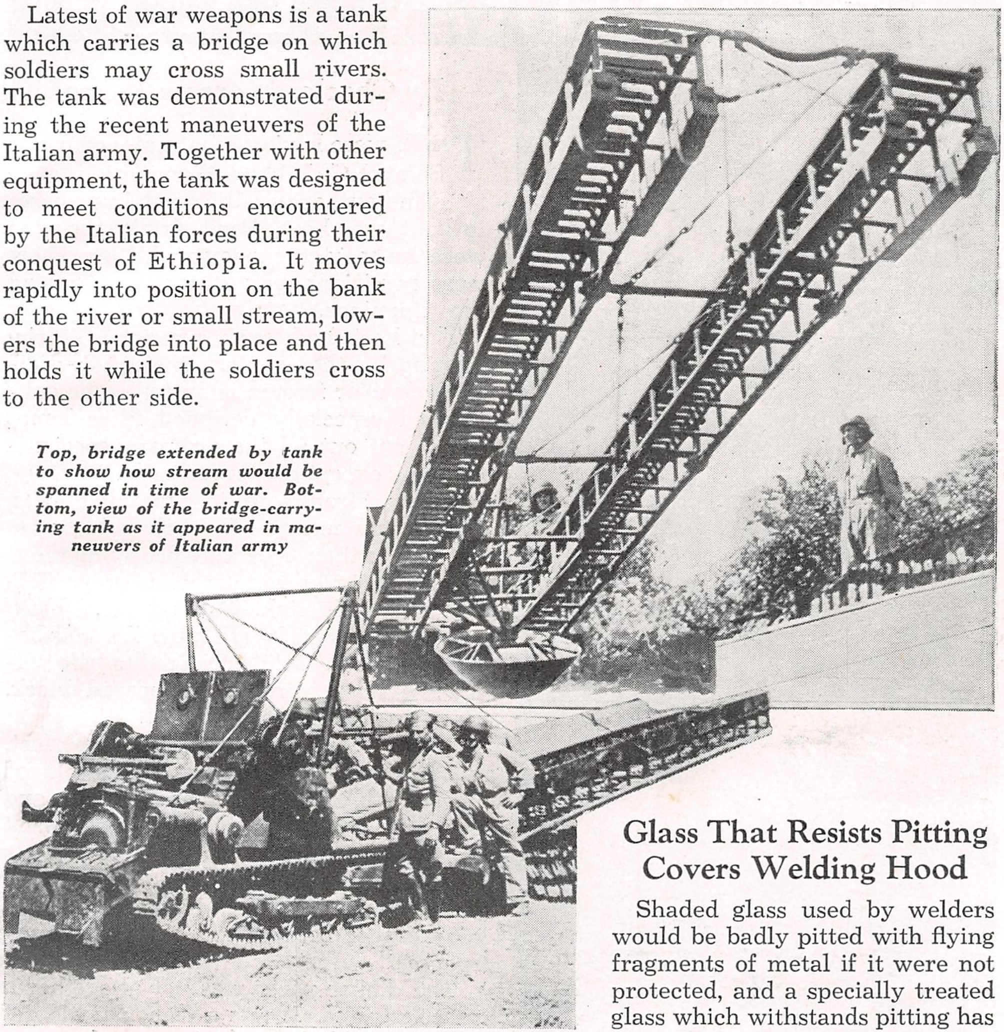
Handy for thawing frozen switches, burning weeds and similar work, a portable blowtorch which operates on gasoline is on the market. It was perfected through cooperation of the U. S. Forest Service which sought an effective means of starting back fires and burning weeds. The torch burns two and one-half hours on one filling of gasoline, three-fourths of one gallon. The intense flame is thrown downward by a coil burner of the fire-pot type. The torch is forty-one inches long and weighs fourteen pounds.



This torch quickly clears switch of snow and ice and it's handy for burning weeds

Tank with Bridge Helps Army Cross River

Latest of war weapons is a tank which carries a bridge on which soldiers may cross small rivers. The tank was demonstrated during the recent maneuvers of the Italian army. Together with other equipment, the tank was designed to meet conditions encountered by the Italian forces during their conquest of Ethiopia. It moves rapidly into position on the bank of the river or small stream, lowers the bridge into place and then holds it while the soldiers cross to the other side.



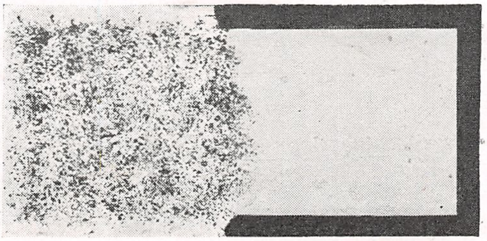
Top, bridge extended by tank to show how stream would be spanned in time of war. Bottom, view of the bridge-carrying tank as it appeared in maneuvers of Italian army

Limits of Space May Be Solved by Two-Hundred Inch Eye

Whether the universe is finite or endless may be solved when the 200-inch telescope of the California Institute of Technology is trained on the heavens. Sir James Jeans, British scientist, points out that the theory of relativity holds that space curves into itself so that its volume is finite, while another theory says space is infinite. Some of the most powerful telescopes today penetrate 240,000,000 light-years in every direction without revealing any limit to space.

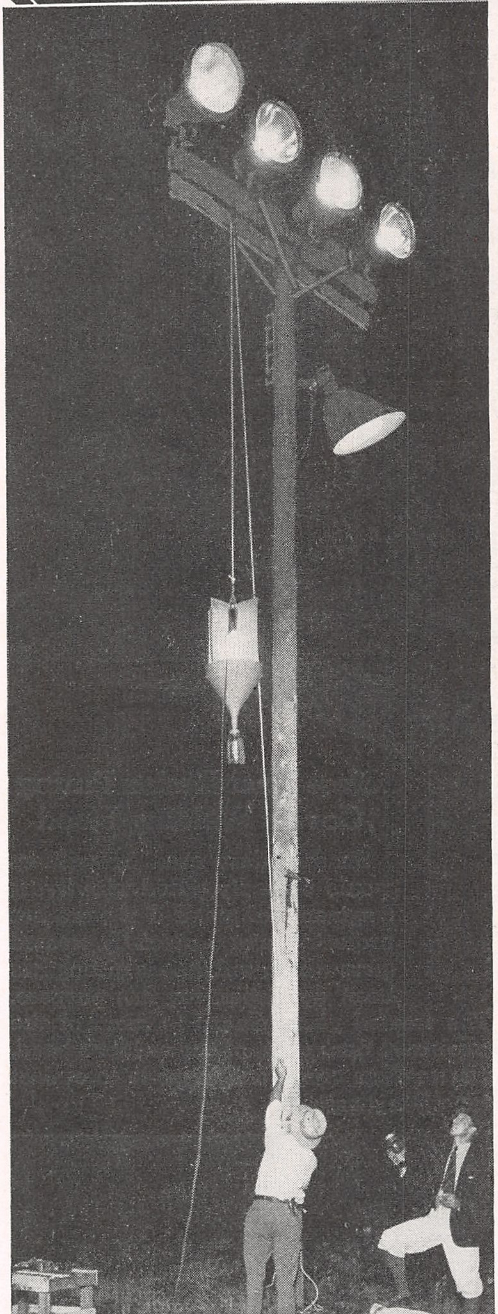
Glass That Resists Pitting Covers Welding Hood

Shaded glass used by welders would be badly pitted with flying fragments of metal if it were not protected, and a specially treated glass which withstands pitting has been developed for this purpose. The treated glass, placed in front of the expensive dark glass of the welder's hood, allows clear vision and is made to outlast ten plain glasses.



Sparks of metal pitted ordinary glass at left but did not affect specially treated glass at right

THE MIRACLES



Attaching beetle trap using ultraviolet lamp as lure to floodlight standard on golf driving course

By Charles Morrow Wilson

THEY were having a light dinner party. Samuel G. Hibben, illumination engineer and authority on light and responses to light, was host. Food, drink, and chef were the best that money could buy. There were musicians, gay storytellers and all the trimmings.

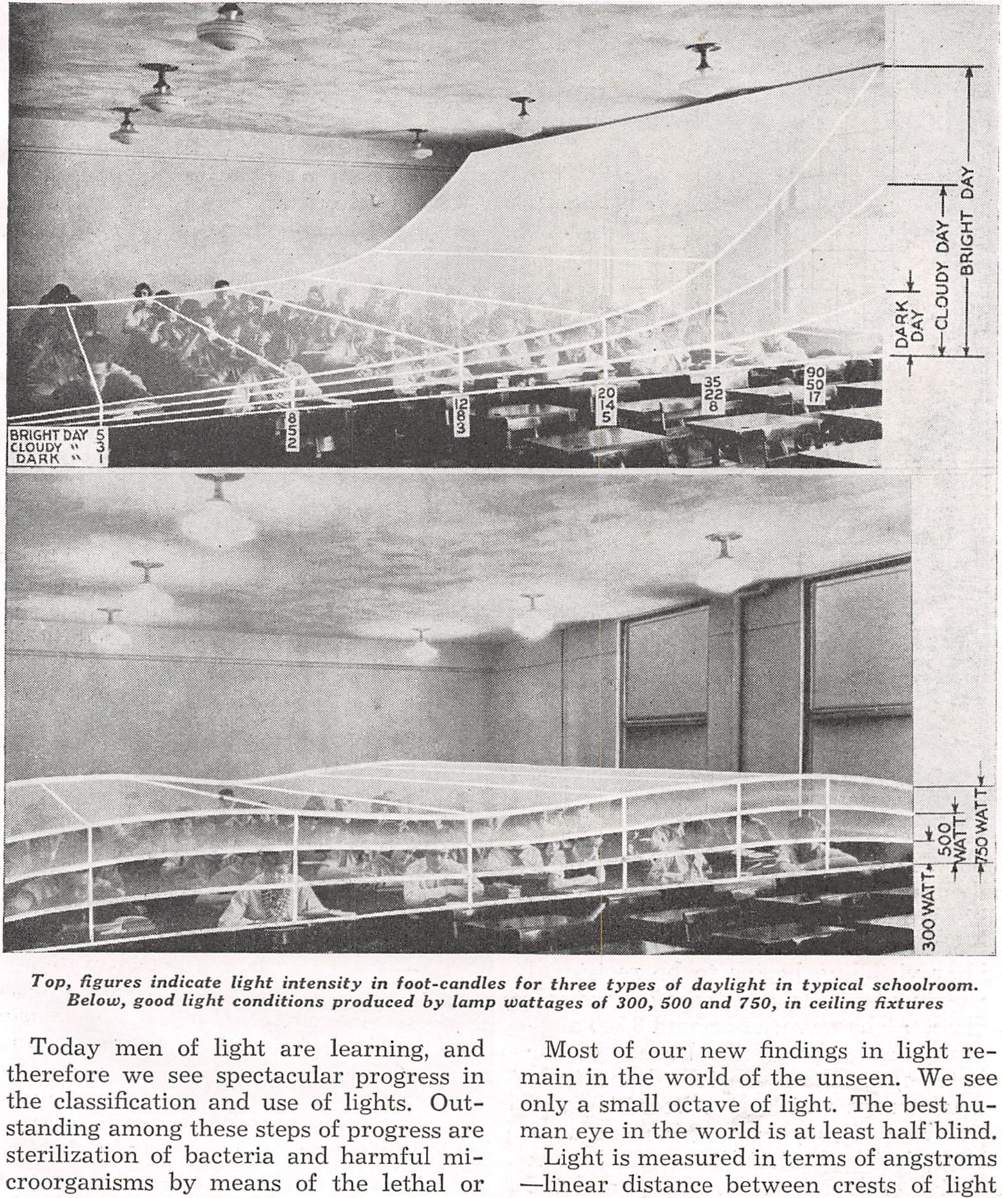
The host had even arranged special lighting for the evening. Instead of ordinary clear or frosted lamp bulbs, he substituted especially designed filter lamps which cut out all the ordinary spectrum of colors except greens and reds.

Guests strolled in to the table, hale, hearty and merry. Then they began to notice that their eyes were deceiving them. Delicious steaks were whitish gray. Celery was gaudy pink. Milk appeared blood red. Salads were bright blue. Lemons became oranges. Coffee changed to pale yellow. Fresh green peas appeared black. Peanuts seemed bright red.

The food and the cooking were perfect, but the broken-spectrum lights played havoc with established senses of color and taste. Therefore the dinner party wasn't especially enjoyable. Most of the guests ate almost nothing. Several left the table prematurely, and two became violently ill after dinner because of "confused eye responses."

The dinner party was not altogether a practical joke. It was a demonstration of the effect of light, not only upon the sense of sight, but upon related senses of taste, smell and touch. It was a pertinent example of the underlying theory of modern light research—that over and above its abstract physical qualities, today's challenge of light is a challenge of individual application and individual reactions to light on the parts of the various orders of life. In order to make plants grow better, we must literally learn how the world looks to a plant. To use light as a defense against insects or bacteria, we must learn something of how the world looks to insects and bacteria. Such learning is a tremendous job.

# of LIGHT

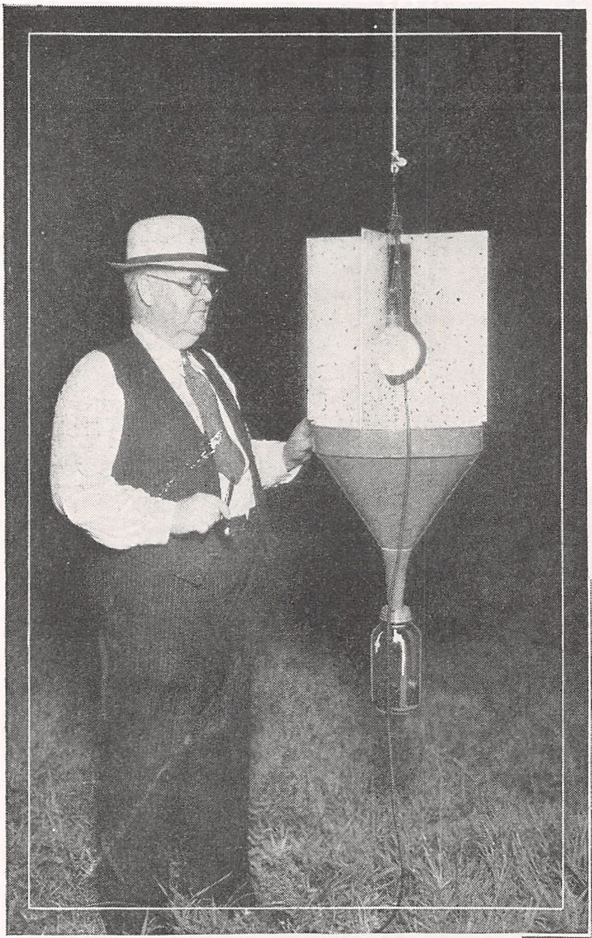


Top, figures indicate light intensity in foot-candles for three types of daylight in typical schoolroom. Below, good light conditions produced by lamp wattages of 300, 500 and 750, in ceiling fixtures

Today men of light are learning, and therefore we see spectacular progress in the classification and use of lights. Outstanding among these steps of progress are sterilization of bacteria and harmful microorganisms by means of the lethal or death ray; trapping of harmful moths and night-flying insects by use of the correct length of light waves; destruction of termites and borers by light; further perfection of the X-ray; better propagation of desirable plants and seed, and destruction of undesirable plants and seeds by the use of light.

Most of our new findings in light remain in the world of the unseen. We see only a small octave of light. The best human eye in the world is at least half blind.

Light is measured in terms of angstroms —linear distance between crests of light waves, which so far as we know are shaped very much like water waves. Nobody ever saw an angstrom. Here's why. Take a medium dull pencil and make a mark on a piece of paper. The width of this mark is probably about one millimeter—roughly one twenty-fifth of an inch. The angstrom is one ten-millionth



of one millimeter. The human eye sees only in terms of light waves between 4,000 and 8,000 angstroms in length. Any wave longer than 8,000 passes out of the range of our visibility, begins to be registered by our nerve ends, and therefore we call it heat. Light waves of around 3,300 angstroms, though below the bounds of our spectrum, are the much talked about ultraviolet rays which give becoming sun tans. The X-ray, as short as ten angstroms, is the shortest light wave known to science. Between the X-ray and the ultraviolet are the more recently segregated lethal or "death" rays, those between 2,000 and 3,000 angstroms in length.

Use of the lethal ray as a potential and powerful agency of destruction today offers some of the most thrilling chapters in the whole thrilling subject of light. Scientifically speaking, the lethal ray is just now being born, and its birth is a tough break for little bugs. Bacteria or microorganisms are its logical prey. In terms of human beings or large animal specie the lethal ray is not yet a "death ray." The actual penetration of the lethal ray remains extremely slight. Under present classification it couldn't dig far enough into a human body to reach a vital organ, though it can cause a malignant skin burn. But it is a dealer of speedy death to bacteria and microorganisms.

For every animal that breathes there are unseen billions of bacteria. Much of this vast bacterial life is helpful to man, in fact indispensable. Yet the bacterial world has its bad actors along with its good ones—decay and mold organisms, disease germs and virus to pillage human health; organisms of infection to endanger wounds and surgery. Surgeons take tremendous pains to sterilize. But wicked

THE STORY OF LIGHT

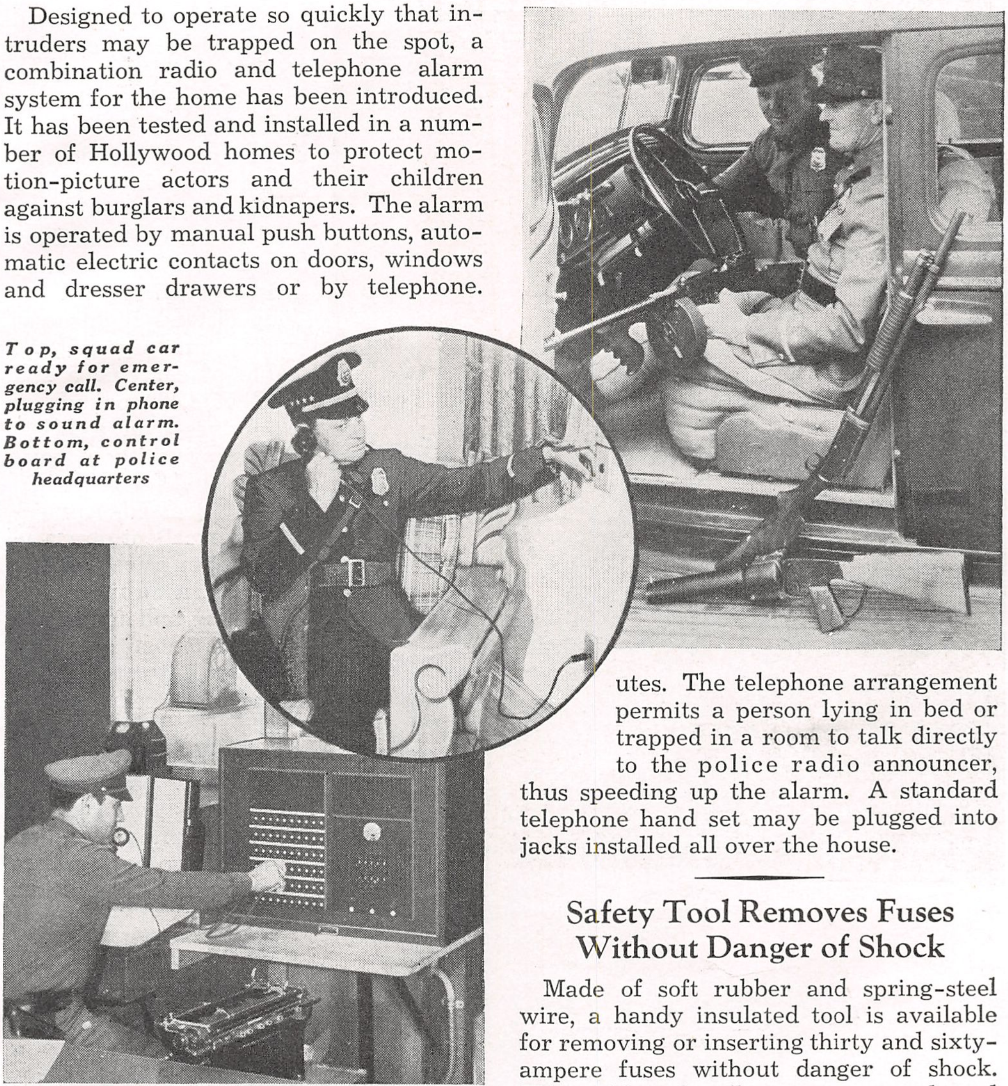
Top photo courtesy Westinghouse Lamp Co.

Top, beetle trap and light. Below, under clock is photoelectric cell which turns on lights in schoolroom when outside light becomes weak

(Continued to page 124A)

Radio-Phone Alarm in House Traps Intruders

Designed to operate so quickly that intruders may be trapped on the spot, a combination radio and telephone alarm system for the home has been introduced. It has been tested and installed in a number of Hollywood homes to protect motion-picture actors and their children against burglars and kidnapers. The alarm is operated by manual push buttons, automatic electric contacts on doors, windows and dresser drawers or by telephone.

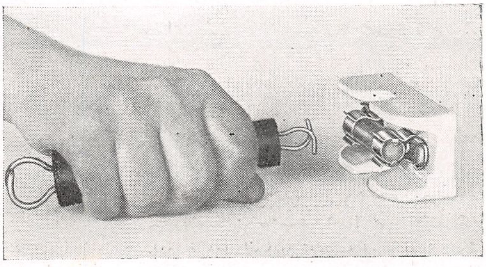


Top, squad car ready for emergency call. Center, plugging in phone to sound alarm. Bottom, control board at police headquarters

Houses are wired so that each danger point is protected by one or more of the safeguards. When the owner leaves the house, he sets a master switch, which is concealed from servants to prevent "inside jobs," and the automatic contacts are ready. The opening of a door, window or a drawer where valuables may be kept causes a light to flash on a control board at police headquarters. An officer on duty there flashes the alarm by radio to the police patrol car in the vicinity and the police reach the scene within a few minutes. The telephone arrangement permits a person lying in bed or trapped in a room to talk directly to the police radio announcer, thus speeding up the alarm. A standard telephone hand set may be plugged into jacks installed all over the house.

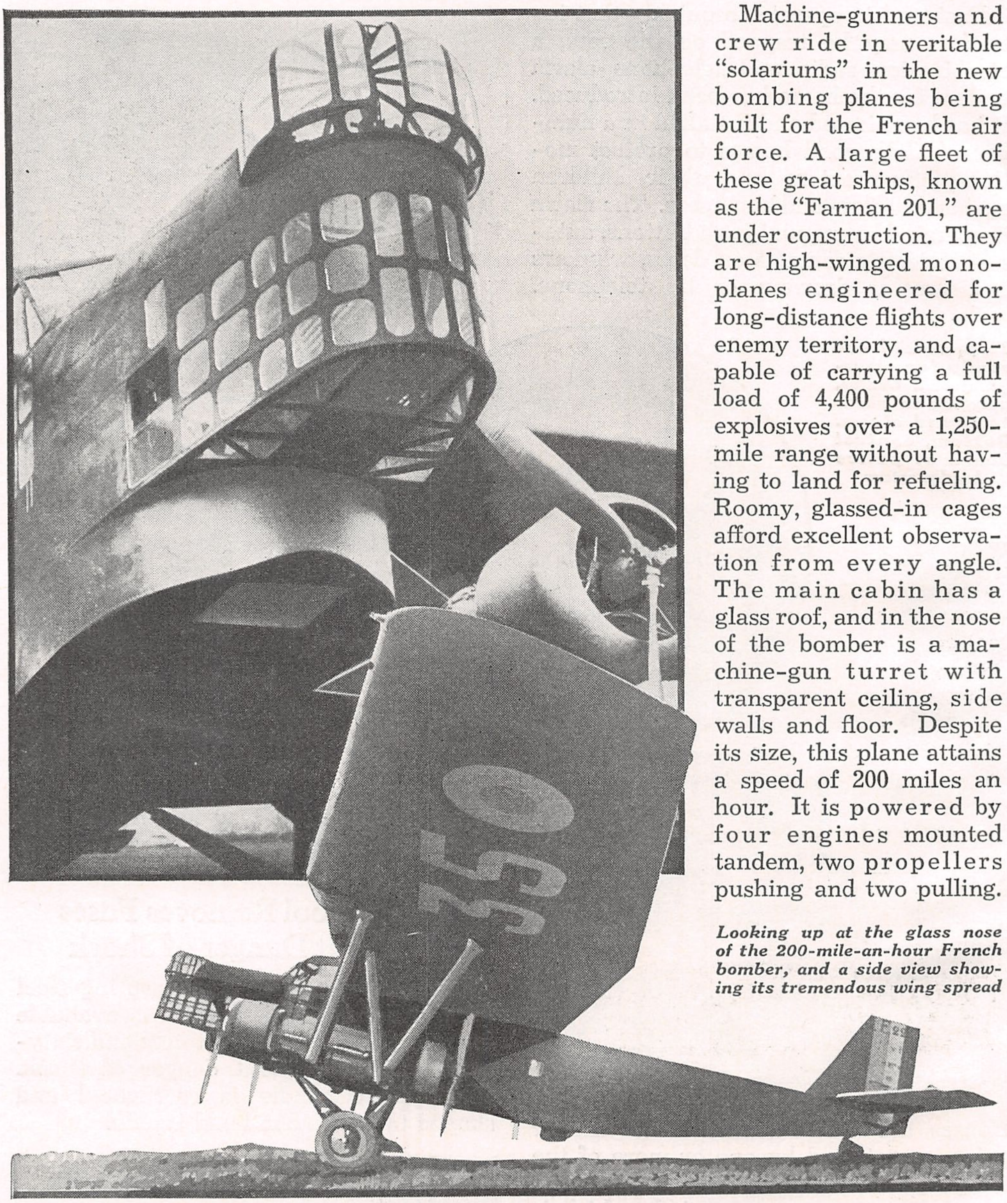
Safety Tool Removes Fuses Without Danger of Shock

Made of soft rubber and spring-steel wire, a handy insulated tool is available for removing or inserting thirty and sixty-ampere fuses without danger of shock. The rubber handle is corrugated and shaped to fit the hand and thumb.



Handy tool for removing fuses. Its rubber handle reduces danger of shock

Blind-Flying Bomber Has Gunner's 'Solarium'



Machine-gunners and crew ride in veritable "solariums" in the new bombing planes being built for the French air force. A large fleet of these great ships, known as the "Farman 201," are under construction. They are high-winged monoplanes engineered for long-distance flights over enemy territory, and capable of carrying a full load of 4,400 pounds of explosives over a 1,250-mile range without having to land for refueling. Roomy, glassed-in cages afford excellent observation from every angle. The main cabin has a glass roof, and in the nose of the bomber is a machine-gun turret with transparent ceiling, side walls and floor. Despite its size, this plane attains a speed of 200 miles an hour. It is powered by four engines mounted tandem, two propellers pushing and two pulling.

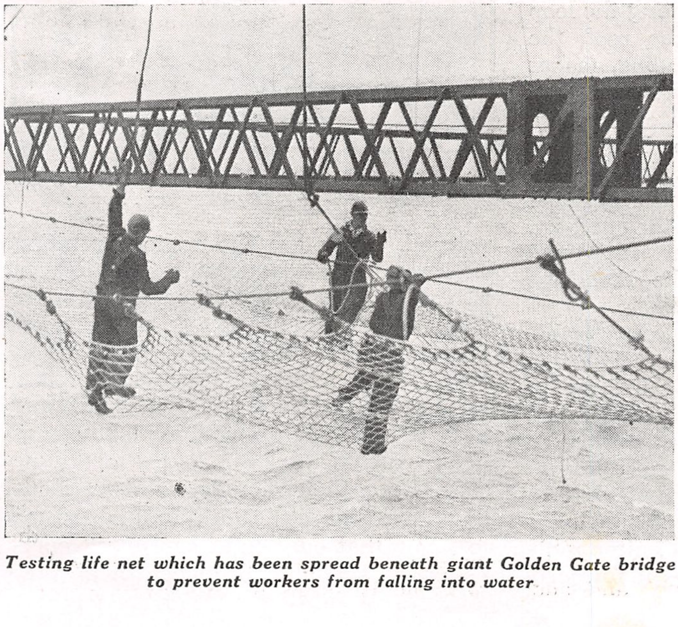
Looking up at the glass nose of the 200-mile-an-hour French bomber, and a side view showing its tremendous wing spread

Single-Motor Submarine Run by Hydrogen and Oxygen

Dispensing with the two heavy Diesel and electric engines which have been used heretofore to drive submarines, Germany is building lightweight subsea craft powered by a single motor driven by oxygen and hydrogen. This radical change in design not only reduces weight and adds flexibility, but simplifies navigation and makes it safer. Submarines of traditional type have required electric engines for undersea propulsion and Diesel engines for operating on the surface, where the batteries are regenerated. In the new ships, with no batteries to tear loose and endanger life aboard with gases, the submarine can dive at any angle and if trapped and disabled on the sea bottom the tanks could be blown up with hydrogen without diminishing the crew's oxygen supply. There is virtually no exhaust to betray the position of the vessel under the sea. The new submarines are capable of high speed on the surface and have a wide cruising range.

Huge Net Guards Workers on Bridge

Spread thirty feet beneath the great Golden Gate bridge at San Francisco, Calif., a giant life net protects workers from falling into the water far below. The net, said to be the first of its kind, is designed to make the bridge the safest job in the world. Similar bridge projects have been marked by numerous deaths of workmen who plummeted from the dizzy heights.



Testing life net which has been spread beneath giant Golden Gate bridge to prevent workers from falling into water

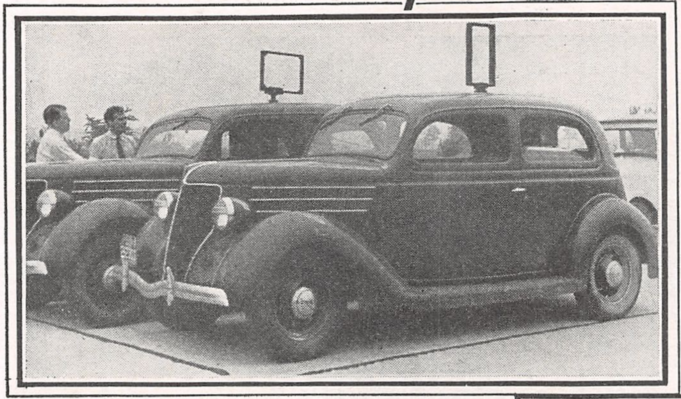
Toy Cars on Miniature Street Test the Fitness of Drivers

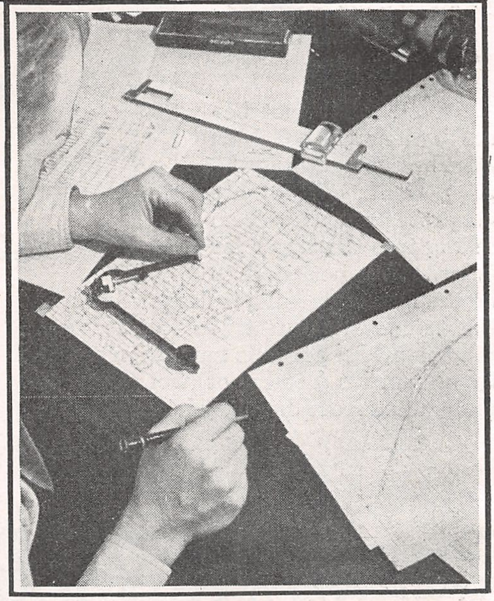
Placing midget vehicles to simulate conditions under which accidents occur. This equipment tests driver's fitness

Using toy automobiles and trucks, Dr. Lowell S. Selling, director of the Detroit psychopathic clinic, tests traffic violators on their fitness to drive. A three-foot-square street intersection is a part of the equipment, Dr. Selling using it to reproduce seventeen traffic violations. Drivers are asked how many violations occurred and what they were. If they recognize the violations and can tell what should be done under the various emergency conditions, they are considered fit to operate a car again.

¶Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

The BIRTH





Plotting coverage chart for radio station, and two cars containing field intensity meters

THE hush of early morning is broken only by the staccato beat of an isolated gasoline engine in a tent in an alfalfa field just beyond the city limits. A sleepy radio operator reads the meters of a portable transmitter and makes an entry in his log. "One more hour," he yawns, "and the job is finished."

On the other side of town a mysterious looking car pulls up at a corner. The driver reads the street names, marks the spot on a map, then snaps on a complicated looking receiving set hung from the roof behind his seat. No sound comes forth. Instead, the needles of two meters swing across the scales. Rotating the loop aerial protruding through the roof, the driver secures maximum reading, makes a note of it, then goes on down the street.

At six o'clock the transmitter operator shuts off the gasoline engine. The driver of the car watches his meters slowly settle to zero, writes "finished" to the log, then heads across town to pick up the operator.

Thus is completed the first important step in building a new radio broadcast station.

Ten years ago it was customary to locate a transmitter on top of the highest building in town. Today the practice is to have the studio in town and the sending equipment as far out in the country as possible. This is because facts are known about radio now, which were not known ten years ago. One of the most startling is that the steel tower makes a better radiating antenna than the wires it formerly supported. With this fact proved, the whole structure of radio transmitters became subject to controversy, and as a result better and more efficient broadcasting stations are in existence today than ever before.

In the last few years a group of highly trained radio men has been developed. They are the radio consulting engineers and their business is to keep abreast of all new developments and apply them where needed. They redesign old stations, select a location for a new one, specify equipment and antenna requirements, and lastly, check everything and tune the station to maximum efficiency before turning it over to the operating staff. Upon their shoulders rests tremendous responsibility, so it is not surprising to know that only eight consulting engineers are available. Between them, they

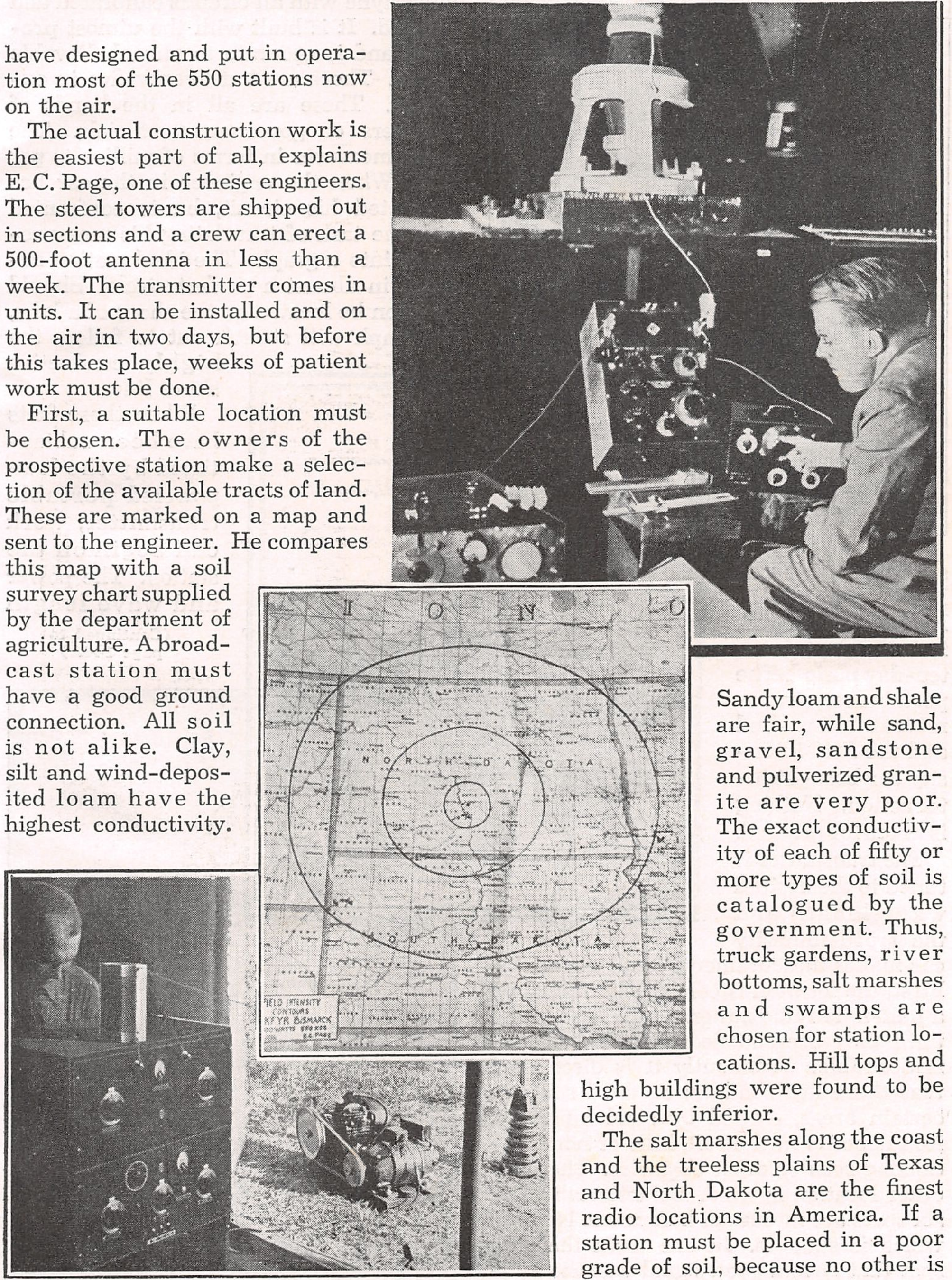
# of a STATION

have designed and put in operation most of the 550 stations now on the air.

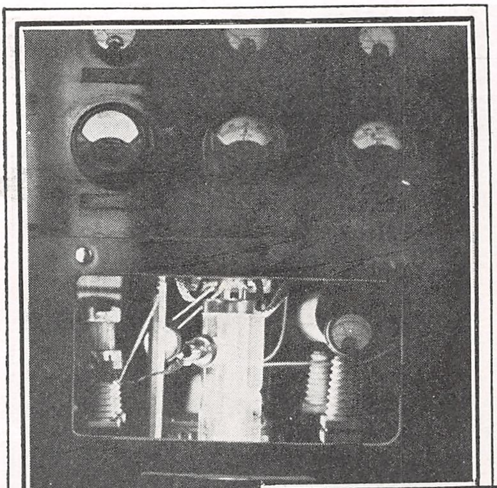
The actual construction work is the easiest part of all, explains E. C. Page, one of these engineers. The steel towers are shipped out in sections and a crew can erect a 500-foot antenna in less than a week. The transmitter comes in units. It can be installed and on the air in two days, but before this takes place, weeks of patient work must be done.

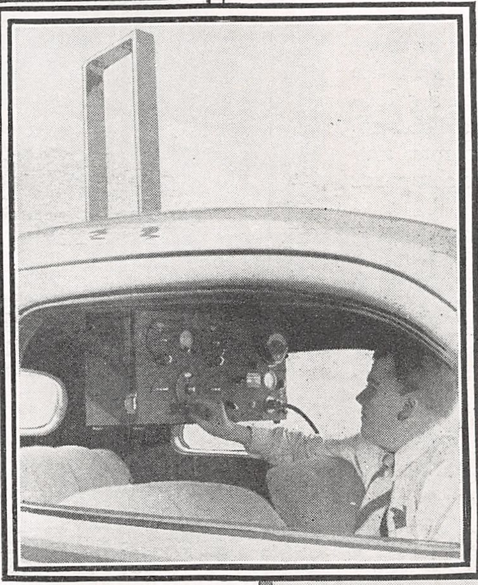
First, a suitable location must be chosen. The owners of the prospective station make a selection of the available tracts of land. These are marked on a map and sent to the engineer. He compares this map with a soil survey chart supplied by the department of agriculture. A broadcast station must have a good ground connection. All soil is not alike. Clay, silt and wind-deposited loam have the highest conductivity. Sandy loam and shale are fair, while sand, gravel, sandstone and pulverized granite are very poor. The exact conductivity of each of fifty or more types of soil is catalogued by the government. Thus, truck gardens, river bottoms, salt marshes and swamps are chosen for station locations. Hill tops and high buildings were found to be decidedly inferior.

The salt marshes along the coast and the treeless plains of Texas and North Dakota are the finest radio locations in America. If a station must be placed in a poor grade of soil, because no other is near, then the closer the wave length is to 550 kilocycles, the greater the efficiency. Before the



Top, measuring characteristics of an antenna. Center, chart shows ideal coverage of Bismarck, N. D., station. Bottom, field set in operation





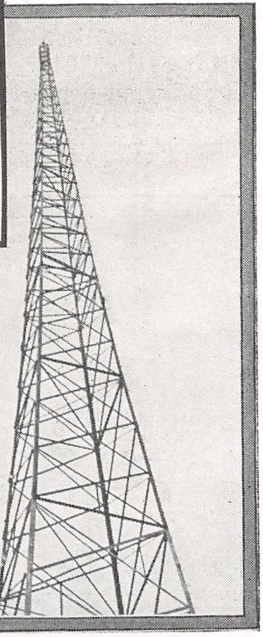
selected piece of land is actually leased or purchased, it is rented for a ten-day period. The portable tent transmitter is installed and the field intensity car brought into action. Nothing is taken for granted.

The transmitter is tuned to the desired wave length and the field intensity car makes measurements in all directions. First, the location is completely circled on a half-mile radius, then a mile, and on up until they are satisfied the selected spot is desirable. Frequently it is discovered that there are shadows or dead spots in certain areas, caused by steel buildings, iron deposits in the soil, hills of non-conducting rock or other obstacles. Then another location is tried. Sometimes five or six spots are measured before one is found which is suitable. In one town the only spot that gave a good signal was the middle of the city dump. In another it was a frog swamp down the river.

A field intensity meter is an instrument which tells exactly how much of the energy radiated by a transmitter is reaching a certain spot. It is an elaborated superheterodyne with all circuits calibrated and metered. It is built with the utmost precision and is accurate to an unbelievable degree. There are but twenty-five in existence. These are all in the hands of engineers or government officials. The meter measures in terms of millivolts per mile. When the engineer in the car has completed his circuit, he is confronted with the task of translating his measurements into a graph. The ideal station radiates in almost a perfect circle. Should a station be located on the shore of a lake, the graph will stretch out to follow the highly conductive shore line.

When these facts have been subtantiated by the low-powered portable transmitter, work can begin on the station. The power and wave length

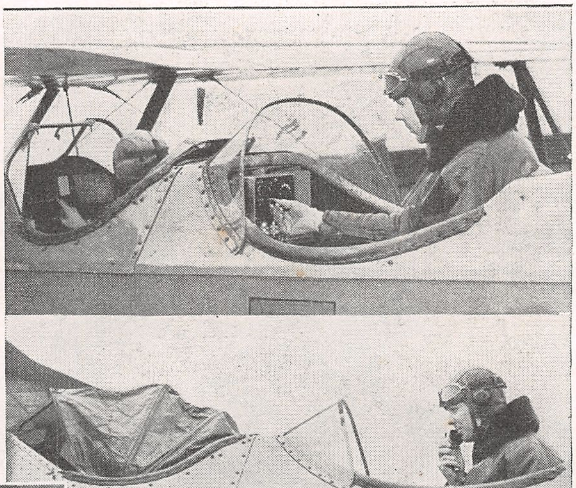
(Continued to page 144A)

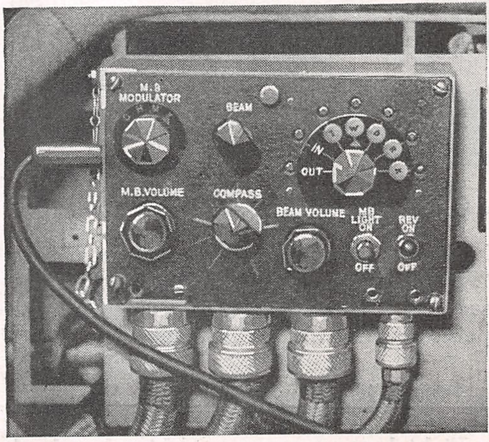


Mast used as aerial, taking reading in a survey car and five-kilowatt tube in transmitter, photographed by its own light

Blind Flying Taught by Radio-Control System

Equipment and a system for teaching blind flying by creating mythical problems for the student to solve have been developed at Wright Field, Dayton, Ohio. The student, in the front cockpit of a two-place training plane, has a hood over his head and sees nothing except the instrument board and controls. The instructor, not hooded, is in the second seat and in communication with the student by two-way telephone. Blind flying is built around the radio compass which may be tuned to any radio station, after which a needle indicator shows the plane's direction in relation to the given station. The new development is a radio-control system which enables the instructor to create radio destinations. By turning a knob, he can make the student's compass needle dip left or right, thus calling for a change in the plane's direction. At the same time the instructor is free to watch the real destination or landmarks. In this way, the instructor may study the student's reactions and his ability at solving hypothetical problems. It also is possible to simulate arrival at a theoretical destination by a marker beacon signal, at the discretion of the instructor, thus calling for the student to make a blind landing. Desirability of a variety of problems not available with "honest" instrument flying suggested the control system.

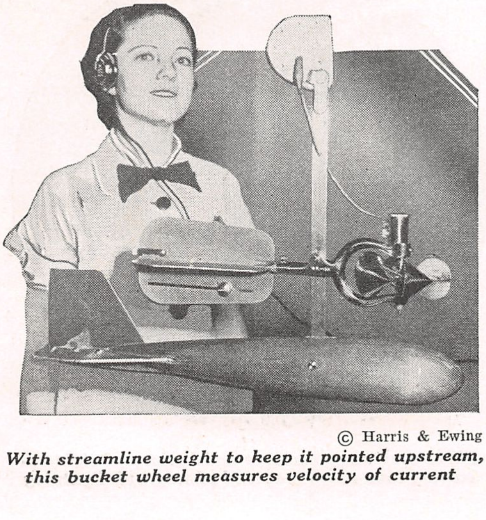




Top, student and instructor ready for flight. Bottom, student under blind-flying hood. Left, control board by which instructor guides student

Bucket Wheel of Current Meter Measures Velocity of Stream

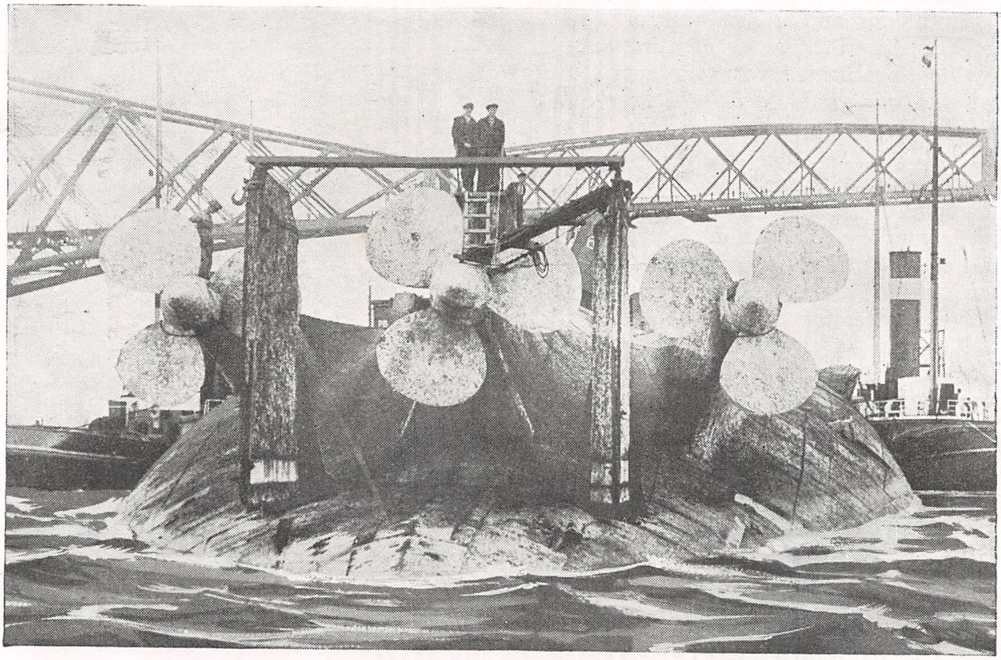
To measure the speed of flow of a river or ocean current, the U. S. Geological Survey uses a bucket wheel which clicks off the number of feet per second of the stream's flow as it revolves. An observer can listen to the clicking with earphones. A streamline weight with fins keeps the meter pointed upstream.



© Harris & Ewing

With streamline weight to keep it pointed upstream, this bucket wheel measures velocity of current

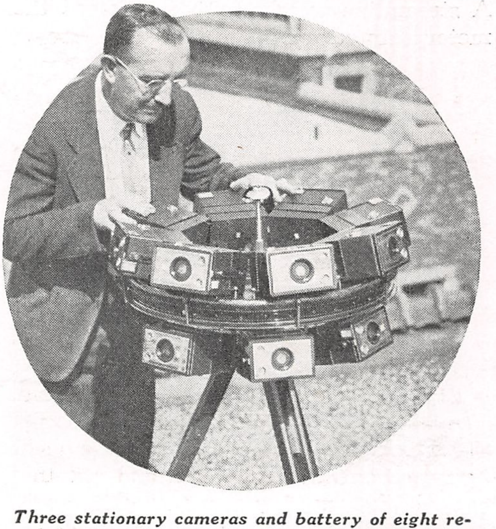
Warship Scuttled by Own Crew Is Salvaged



Huge hulk of German warship as it passed under Forth Bridge on way to salvage yard after being raised from bottom of sea. Note that it is being towed upside down

Scuttled by its crew after surrender in the world war, the German battleship "Kaiserin" has been raised and towed to a salvage company to be broken up. Metal in the great vessel will be reclaimed. The "Kaiserin" was towed, upside down, to the salvaging company's dock, passing at one point beneath the Forth bridge.

Cameras Spin on Bicycle Wheel to Film Lightning Streak



Three stationary cameras and battery of eight revolving four times a second photograph lightning

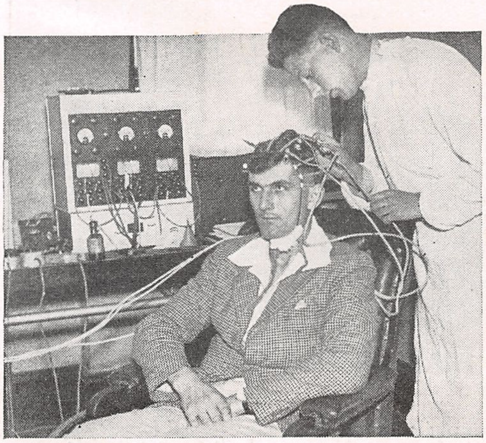
Eight box cameras on a bicycle wheel are the "lightning chasers" built by Prof. John G. Albright of the Case School of Applied Science to trap lightning on film. Fast enough to photograph the component strokes of a lightning flash, its wheel is revolved four times a second while pictures are taken. In addition to the eight rotating cameras on the wheel there are three stationary cameras.

Backwash of Huge Liners Perils Small Craft

Serious damage to small craft often results from the backwash created by huge ocean liners steaming up narrow channels or moving into docks. The backwash is caused by the water displaced by the liner being forced astern by the propeller at the same speed that the ship is moving ahead. Thus, a liner displacing ninety thousand tons of water and moving at ten knots will create a backwash of 90,000 tons of water traveling 1,000 feet per minute. The resulting high wave sometimes travels for miles before its force is spent. Frequently bathers on exposed beaches are swept out from or onto the shore, decks of passing vessels are swept and docks and craft moored at docks are damaged. When the "Queen Mary" was docking recently, the backwash picked up a ferryboat half a mile away and dashed it against the bulkhead of a slip so hard that most of the ferryboat's 200 passengers were knocked down and some were injured. Small boats within two miles of passing liners frequently are overturned and cargo stowed on piers is ruined by waves set in motion by a large ship whose engines may be turning "dead slow," just fast enough to keep the liner on course.

Brain Waves Are Measured with Radio Amplifier

With an ordinary radio set for an amplifier, a young scientist at London is measuring brain waves. A fairly regular electrical wave emanates from the human brain during normal thought, but the waves diminish during sleep. The intensity of the waves is measured on an electric meter, enabling research men to study the relative intensity of thought processes.



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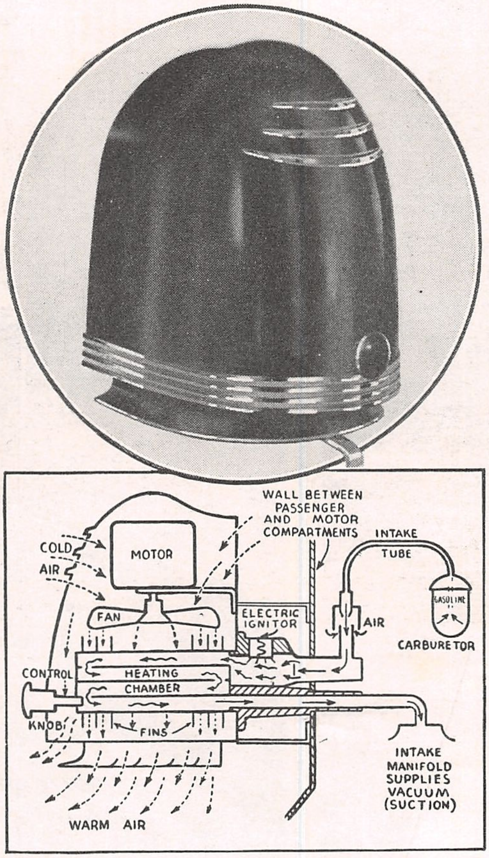
Measuring intensity of thought in terms of electricity generated by "brain waves"

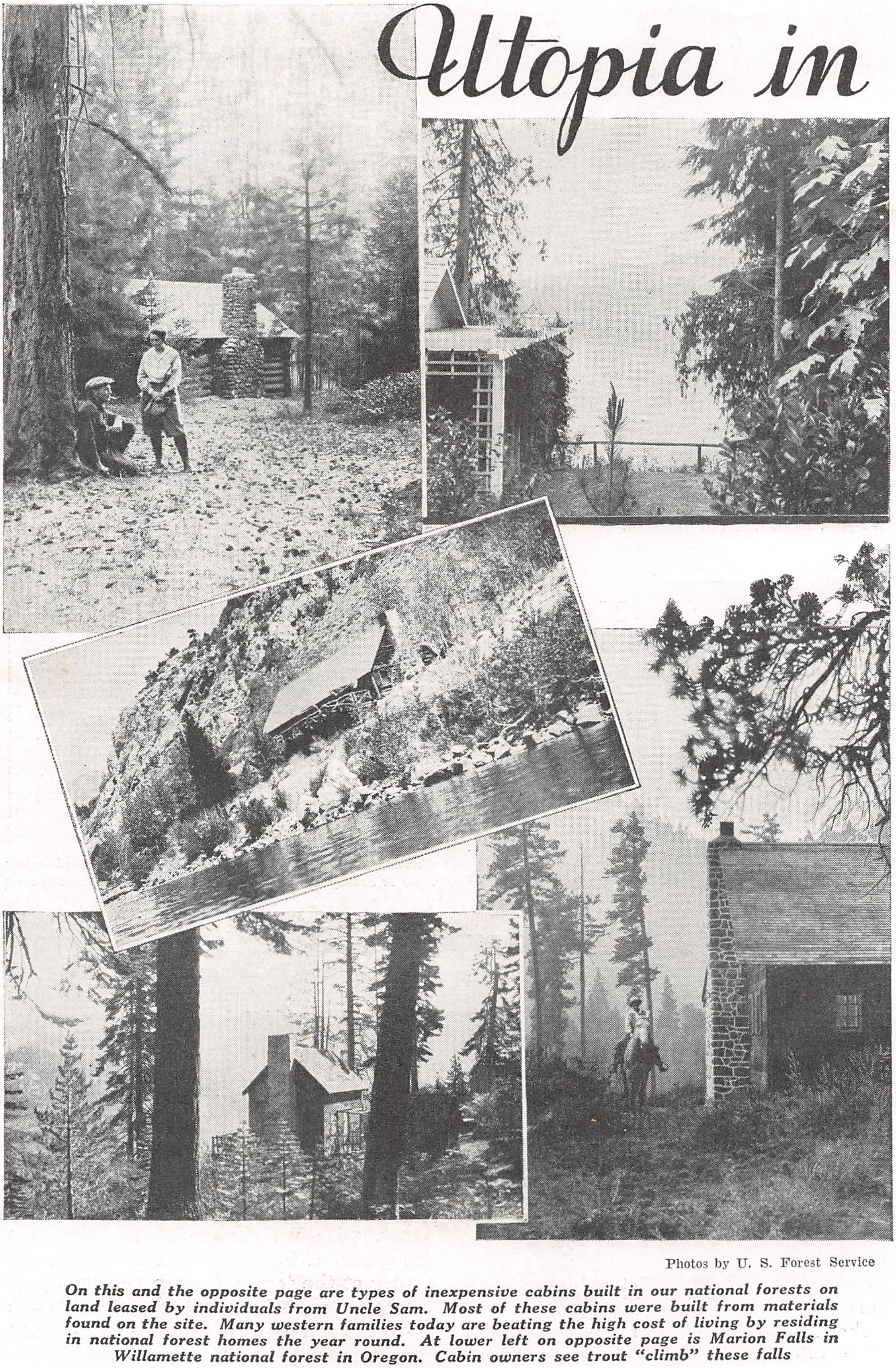
Auto Heater Burns Gasoline Drawn from Carburetor



Compact automobile heater and diagram showing how it safely burns gasoline drawn from carburetor

Warm air flows almost instantaneously from an automobile heater burning gasoline drawn from the carburetor. There is no waiting for the cooling system to heat up. Using the intake manifold vacuum, gasoline is sucked from the carburetor, mixed with air and ignited in a sealed combustion chamber under vacuum. An electrically heated Nichrome wire starts the gas burning. The flame flows through multiple passages in a radiator with copper fins over which air is circulated. Combustion fumes pass on to the motor exhaust, with no chance of reaching the occupants of the car. Cold air enters the heater at the top and a fan drives it past the copper heating elements and out the base, the fan starting automatically when the air reaches the required temperature.

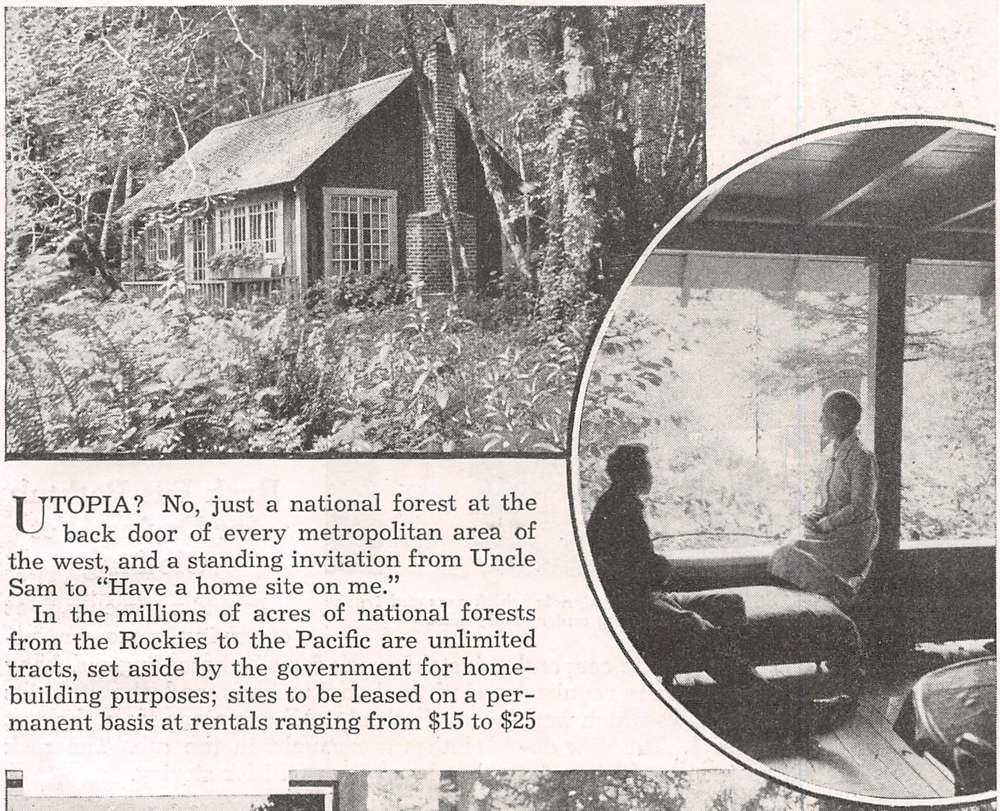
Utopia in



Photos by U. S. Forest Service

On this and the opposite page are types of inexpensive cabins built in our national forests on land leased by individuals from Uncle Sam. Most of these cabins were built from materials found on the site. Many western families today are beating the high cost of living by residing in national forest homes the year round. At lower left on opposite page is Marion Falls in Willamette national forest in Oregon. Cabin owners see trout "climb" these falls

the Tall Timbers



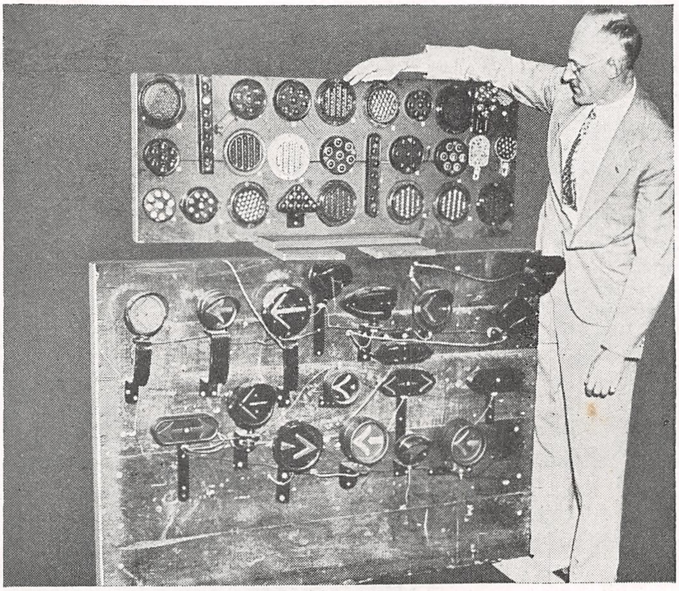
UTOPIA? No, just a national forest at the back door of every metropolitan area of the west, and a standing invitation from Uncle Sam to "Have a home site on me."

In the millions of acres of national forests from the Rockies to the Pacific are unlimited tracts, set aside by the government for home-building purposes; sites to be leased on a permanent basis at rentals ranging from $15 to $25 a year, fuel free, construction material priced so low the builder doesn't know whether to pay or apologize.

Building restrictions call for an expenditure of $500 for materials and labor. If a lessee is proficient with saw and hammer, or knows how to plumb a wall and wield

(Continued to page 139A)

Car and Truck Safety Signals Required by New State Law



Here are reflectors and directional turning signals which cars and trucks in New York state are installing under safety laws

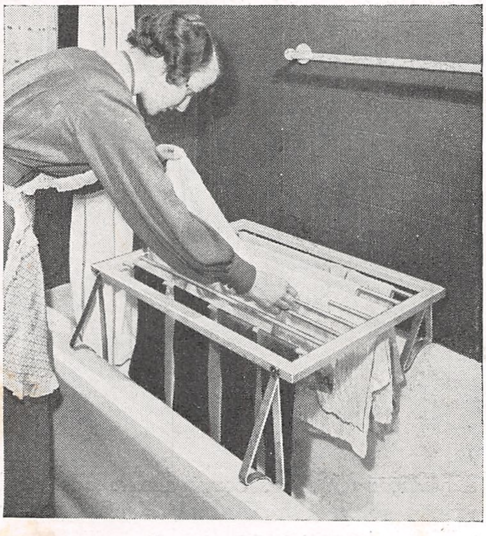
Improved reflectors for private cars and directional signals for trucks are required by New York's vehicular laws which went into effect on September 1. The new devices are designed to increase safety for all drivers. The directional signals are to be used by truck drivers to indicate the direction in which the vehicle will turn and to warn when a stop is to be made. Various types of the safety devices have been collected by the motor vehicle bureau for examination.

Tannin Stain Remover Sought by Cleaning Industry

Tannin stains, caused by dropping tea, coffee, orange juice and many kinds of foods on clothing, challenge the chemical world. So eager is the cleaning industry to obtain a remover for such stains that a reward of $1,000 awaits the discoverer of a practical solution. In addition, the remover would be in such demand that it might easily be worth a fortune if the discoverer manufactured and marketed it himself. Tannin, a generic name for tannic acids, can be found in practically all the higher plants. When spots of beverages and some foodstuffs are dropped on suits and dresses, they harden and set in the fabric. In the process of dry cleaning, they turn into yellowish-brown stains which defy all known cleaning fluids. Competition for the $1,000 prize will be open until January, 1938. A board of judges representing every division of the dry-cleaning industry will decide upon the effectiveness of solutions submitted in the contest.

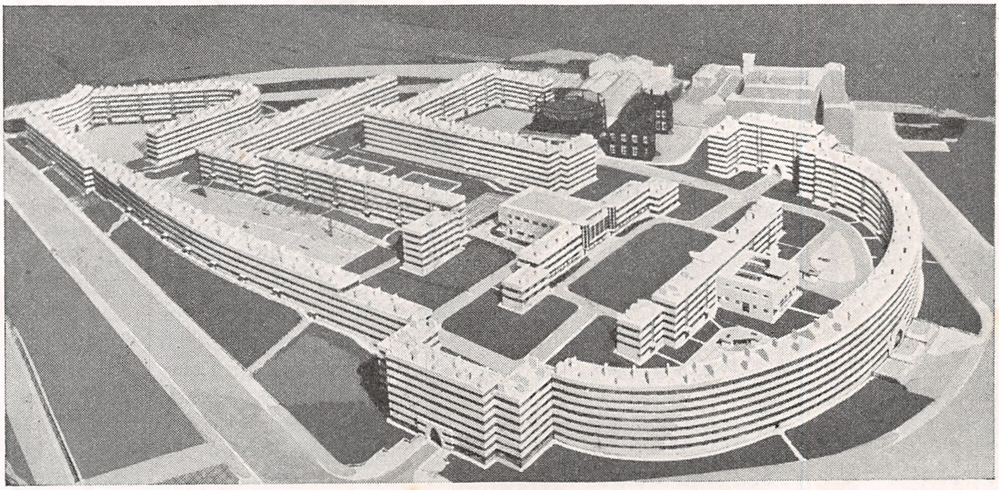
Rack Fits Bathtub for Drying Wet Clothing

Providing twenty feet of drying space, an adjustable rack for silk hose, lingerie, baby clothes, handkerchiefs and the like fits any bathtub. All drippings from the wet clothes are caught in the tub. The rack has legs which fold for storing.



This handy rack fits on bathtub for drying clothes. It folds for storing

Giant Apartment Is Built Like a Walled City



Vast housing project in England which will have living accommodations for more than 4,000

Really a city in itself, a vast community project being built at Leeds, England, has 939 apartments. It is designed along modern architectural lines and resembles a walled city. Besides the apartments, there are twenty shops, a community hall, a clinic and power plant. The community is to be ready for occupancy in 1938.

Sculptor Carves Image in Snow Like Stone Memorial

Like the vast memorial being carved in rock at Mt. Rushmore in South Dakota, a giant head with a group of figures at its base has been carved by a sculptor in Switzerland. But this head was shaped not from a mountain of rock, but of snow.

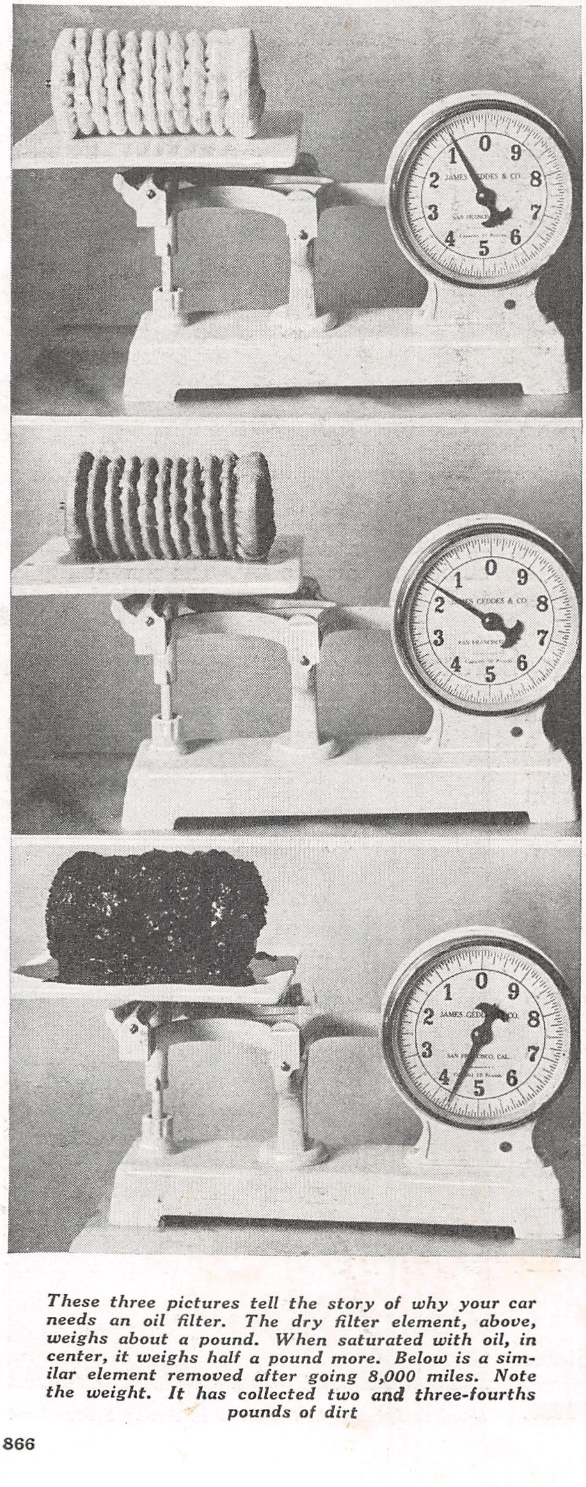
Head sculptured in the snow at Arosa, Switzerland

Coal Wrapped in "Cellophane" Is Clean to Handle

Coal comes wrapped in Cellophane now. You can handle it without gloves. Bituminous coal compressed into a four-inch cube and packaged in a neat transparent wrapper was introduced recently to the fuel trade, and coal men predicted that the basement coal pile and its dust would become obsolete in a few years. The housewife can toss newspapers into the furnace or stove, lay a few Cellophane coal cubes on top without soiling her hands and start the fire.

¶Scheduled air lines of the United States flew 7,574,134 passenger-miles per passenger fatality in the first six months of 1936.

WHY YOUR CAR *needs*



These three pictures tell the story of why your car needs an oil filter. The dry filter element, above, weighs about a pound. When saturated with oil, in center, it weighs half a pound more. Below is a similar element removed after going 8,000 miles. Note the weight. It has collected two and three-fourths pounds of dirt

BE SURE your car is equipped with an oil filter. Any good filter will save you in repair bills many times its cost. Change your oil as often as you think necessary, but don't rely on a change of oil to get rid of sludge, one of your motor's worst enemies. Only a good oil filter will do that.

Every driver knows good lubrication is essential to efficient and economical engine performance and realizes, at least vaguely, that only a thin film of oil protects many of the moving parts of his engine from excessive friction, heat and wear. Few car owners, however, know just what proper lubrication involves.

Efficient lubrication of present-day motors demands the delivery of from 100 to 250 gallons of oil per hour to the bearings and working engine parts. That's from 400 to 1,000 quarts of oil which must be produced by the repeated use of the six or eight quarts the average crankcase holds.

Until a few years ago, most car owners believed all that was necessary to insure good lubrication was to change the oil at regular intervals, keep the level at the "full" mark on the stick and flush out the engine once in a while. They accepted occasional burned-out bearings and the replacement of worn working parts of the motor as necessary operating expenses. No one blamed inefficient lubrication for such repair bills if he changed oil every 1,000 miles or so.

Then research engineers began to study the behavior of hot oil at high speed. They learned that when the oil is whipped up in the presence of air or water, the latter the result of condensation in the motor, a gummy accumulation of the insoluble parts of the oil is formed. This is known as sludge,

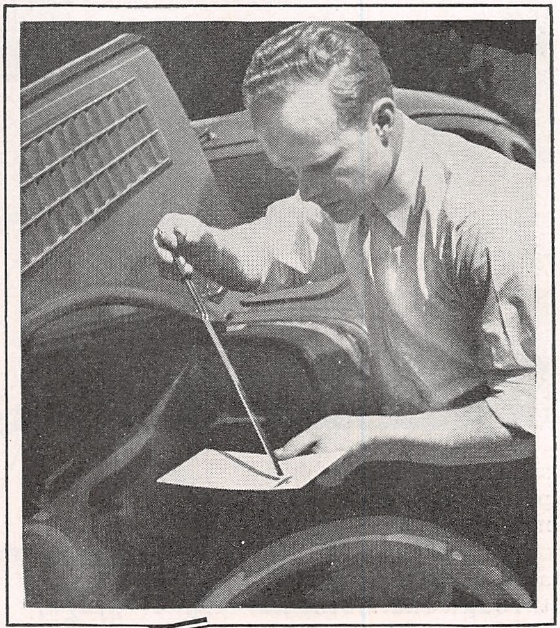
an OIL FILTER

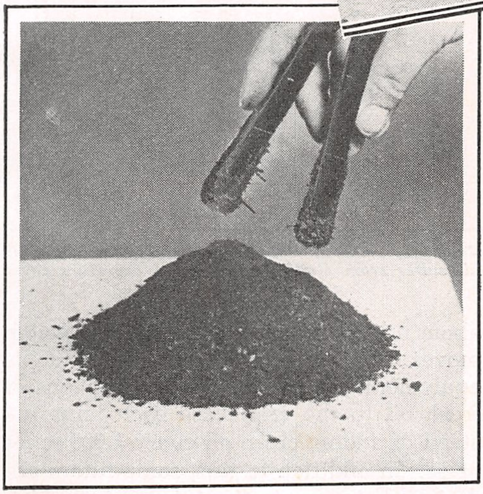
and sludge has an affinity for solids. And the jellylike clots of oil and water, getting a free ride through the oil stream, find plenty of solids with which to join. They pick up road dust—bits of ground-up rock, cement and sand which have entered the crankcase through the breather and carburetor; small grains of core sand jarred loose from the engine block; minute particles of hard carbon and other products of combustion and pieces of metal sheared from working parts of the motor.

The oil carries this abrasive compound into main bearings where a film of oil, often only one-thousandth of an inch thick, is supposed to form a cushion between the crankshaft and bearing. The gritty particles are set into the soft metal of the bearing bushing and soon the crankshaft is scraping over a bed of abrasives instead of riding on a cushion of oil. Then there's a burned-out bearing.

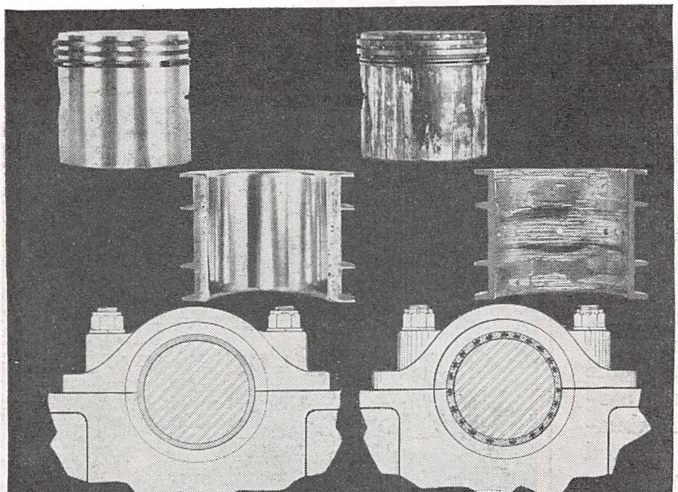
But this is only part of the story. Most connecting-rod bearings are fed with oil forced under pressure from the main bearing through channels drilled in the crankshaft. The revolving crankshaft forms a centrifuge which throws the oil against the sides of the channel and the sludge adheres to the sides. Beginning as a thin film, the deposit grows thicker, acquiring a steellike hardness and gradually filling up the oil passage. Then connecting-rod bearings do not receive enough oil and there's another repair bill. So harsh is the abrasive compound that tractors without protective devices working in very dusty fields have required a major overhaul after only a few hours of service.

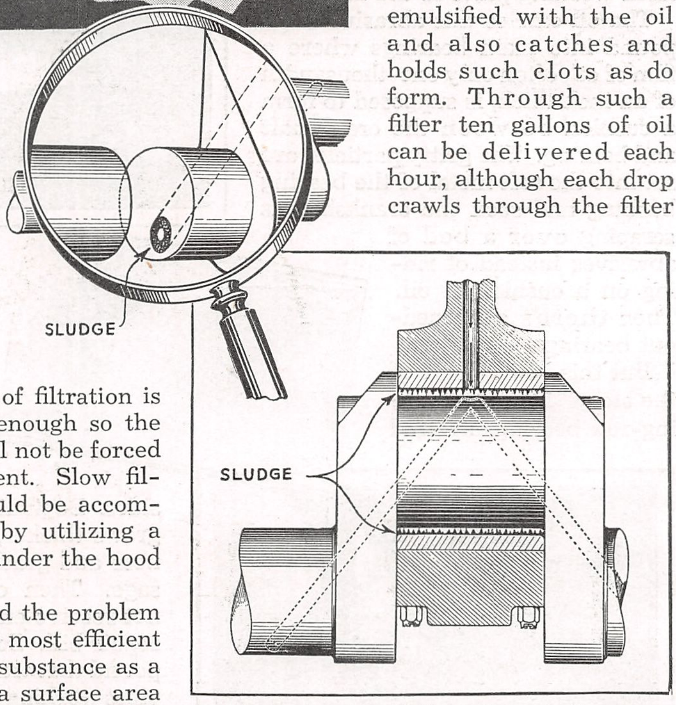
Since sludge is formed partly of substances in the oil, partly of substances which are the products of combustion and partly of substances which seep into the crankcase, it was obvious that merely changing oil at regular intervals would not eliminate sludge but would only get rid of the sludge which happened to be suspended in the oil stream. So the engineers decided to filter it out. That sounded





Top, making blotter test. Center, light spot is clean oil, dark one is dirty oil. Below, dirt removed from used oil filter element





Bearings, pistons, cylinder walls and oil passages all suffer from sludge, as you can see from these pictures and drawings

simple, but the problem proved almost insurmountable.

The entire contents of a crankcase are carried through the motor at least once a minute and sometimes as often as each twenty-five seconds. This speed alone appeared to bar the practical functioning of any filter since a first principle of filtration is that it must occur slowly enough so the substance to be removed will not be forced through the filtering element. Slow filtration in large volume could be accomplished, it appeared, only by utilizing a filter too big to be carried under the hood of a car.

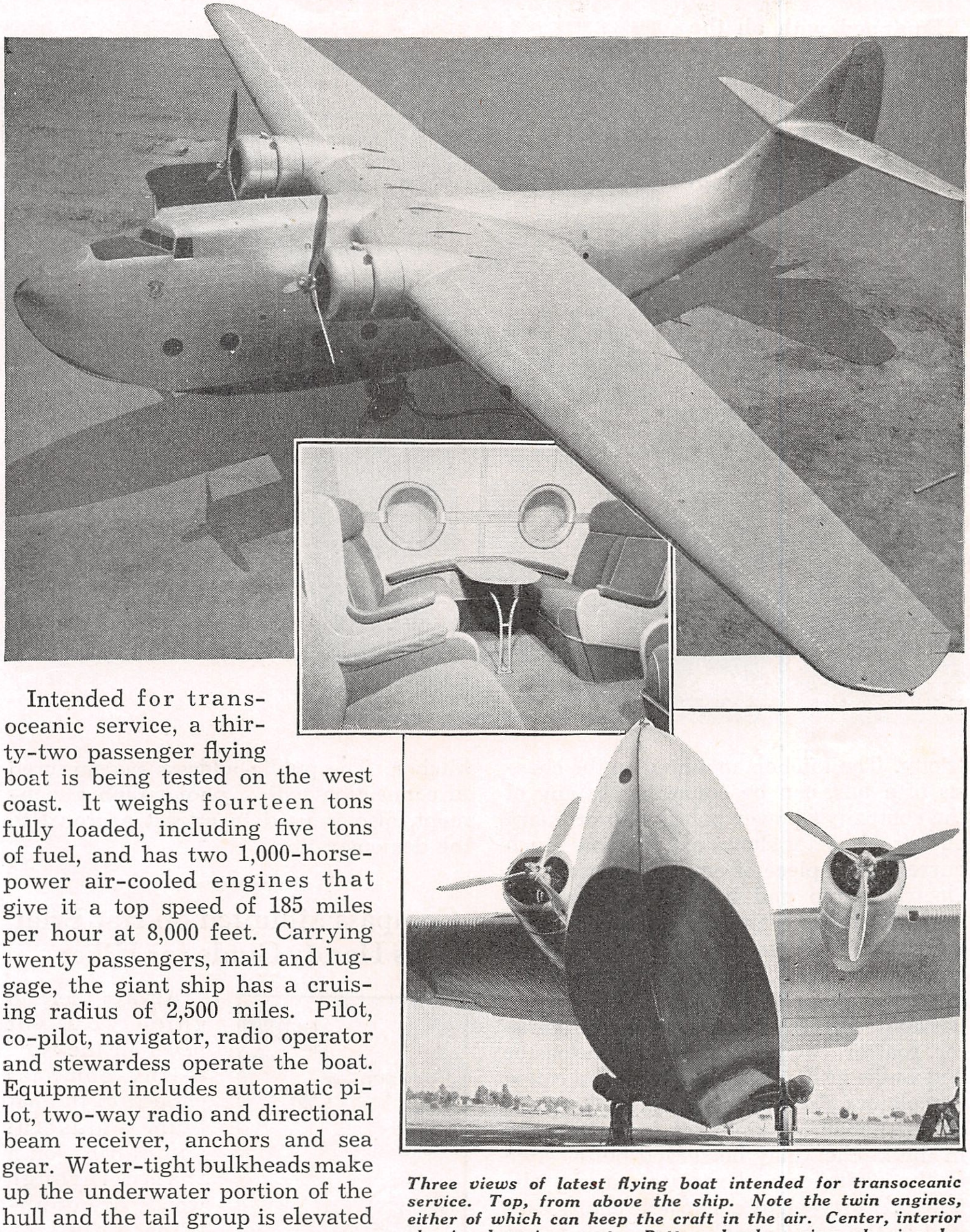
Filtration engineers solved the problem in various ways, one of the most efficient methods being to use some substance as a filter element which offers a surface area much greater than the interior of the container holding the element. This is known as an extended area filter and the principle involved is protected by patent. Most filters produced today are of the absorption or depth type, and common substances used as filtering elements include Spanish moss, curled hair, cotton, some cellulose products, fuller's earth and rock wool.

The early idea was to filter out sludge after it had formed rather than to prevent its formation. Having accomplished this, engineers went a step further. Why not, they asked themselves, remove the substances which go to make up sludge before they have had a chance to combine instead of afterward?

And that is what a good oil filter is designed to accomplish for your motor today. It filters out of the oil stream the grit and carbon and bits of metal. It traps most of the water before it has emulsified with the oil and also catches and holds such clots as do form. Through such a filter ten gallons of oil can be delivered each hour, although each drop crawls through the filter about as fast as the hour hand of a watch moves. The action of such a filter is equivalent to adding about ten gallons of fresh oil to the crankcase each hour instead of adding clean oil every 1,000 miles or so. In addition to this, some filters are designed to neutralize the acid which forms in the crankcase by virtue of the

(Continued to page 160A)

Huge Flying Boat Tested for Ocean Service

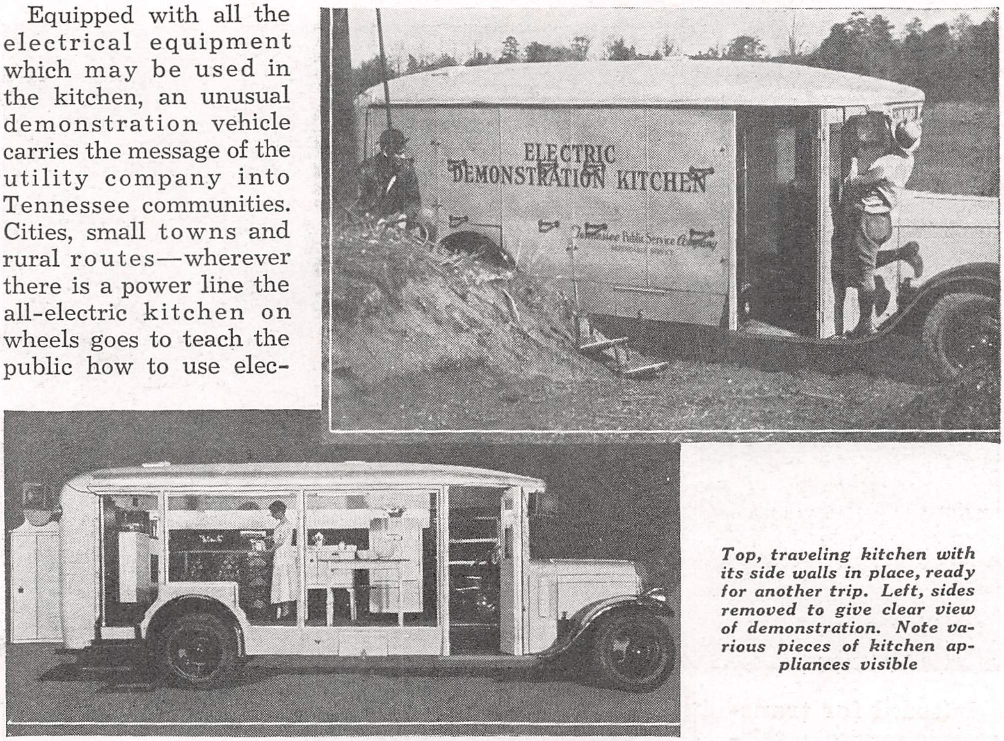


Three views of latest flying boat intended for transoceanic service. Top, from above the ship. Note the twin engines, either of which can keep the craft in the air. Center, interior showing luxurious seats. Bottom, head-on view, showing details of the boat-like hull. Note the three-blade propellers and position of the engines

Intended for transoceanic service, a thirty-two passenger flying boat is being tested on the west coast. It weighs fourteen tons fully loaded, including five tons of fuel, and has two 1,000-horsepower air-cooled engines that give it a top speed of 185 miles per hour at 8,000 feet. Carrying twenty passengers, mail and luggage, the giant ship has a cruising radius of 2,500 miles. Pilot, co-pilot, navigator, radio operator and stewardess operate the boat. Equipment includes automatic pilot, two-way radio and directional beam receiver, anchors and sea gear. Water-tight bulkheads make up the underwater portion of the hull and the tail group is elevated above the water to prevent submersion during takeoffs. Retractable wing pontoons can be folded into the wings when the ship is in the air. The passenger cabin has eight compartments seating four persons each. The fuselage is air conditioned and sound insulated. Seventy feet long and with a wing spread of ninety-five feet, the flying boat can be kept in the air with only one of its two engines running.

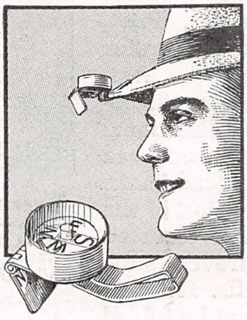
All-Electric Kitchen Is Mounted on Wheels

Equipped with all the electrical equipment which may be used in the kitchen, an unusual demonstration vehicle carries the message of the utility company into Tennessee communities. Cities, small towns and rural routes—wherever there is a power line the all-electric kitchen on wheels goes to teach the public how to use electricity. The kitchen, mounted on the chassis of a bus, can be connected to any of the company's power poles or to ordinary outlets. A meter shows exactly how much current each piece of equipment uses. An electric pump and two tanks solve the problem of tap water for the dishwasher and a table-top heater holds thirty gallons of water. A two-gallon electric coffee maker enables the demonstrator to supply her audience. An electric range, refrigerator, roaster, combination sandwich toaster and waffle grid, mixing machine and coffee percolators also are arranged in the traveling kitchen. Samples of food prepared in the kitchen may be served buffet style to the audience and recipes may be obtained. Forty-eight collapsible chairs carried in the vehicle make it possible to set the stage for the demonstration in the open. Sides of the kitchen are removable. On rainy days, a buttonhole microphone connected to a public-address system enables the demonstrator to address her audience seated in a glass-front building as she carries on the demonstration in the kitchen. The public-address system, used in connection with a phonograph attachment, also is used to attract a crowd to the demonstration.



Top, traveling kitchen with its side walls in place, ready for another trip. Left, sides removed to give clear view of demonstration. Note various pieces of kitchen appliances visible

Compass Mounted on Hat Brim Is Handy Guide for Hiker



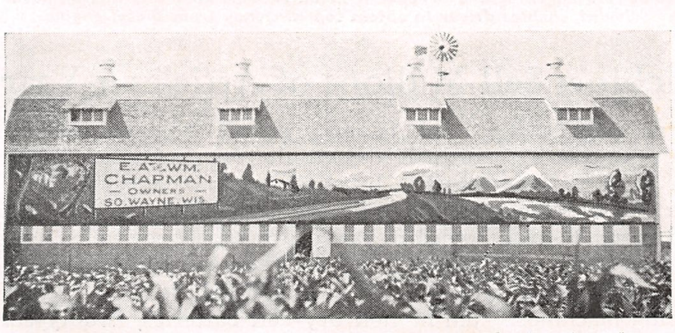
Always there to guide you, yet never in the way, a tiny compass clipped to the hat brim is a useful companion on a tramp through woods or mountains, a hunting trip, or bicycle expedition. It clips on the hat or cap just above the line of vision. A floating disk with the needle attached bears the initials of the four points of the compass, and through a window in the base the direction you are facing, "W" if west, is reflected to your eye on a small chromium mirror. An upward glance sets you in the right direction.

Fluid for Removing Adhesive Tape Is Non-Explosive

Two safe preparations for the removal of adhesive tape have been approved by medical men, who recommend their use instead of kerosene or gasoline with their attendant danger of explosion. One of the approved substances consists of ninety-eight per cent dichloromethane, which is nonexplosive and noninflammable. The other is sixty per cent carbon tetrachloride and forty per cent naphtha with a small amount of oil of sassafras, which might burn but would not explode. If carbon tetrachloride is used, physicians warn of some danger of its poisonous fumes if they become concentrated in a closed room.

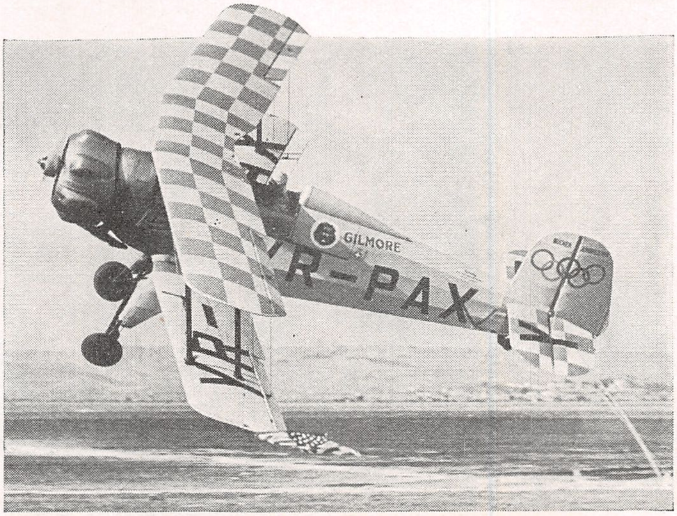
Mural Landscape Is Painted on Huge Dairy Barn

On the broad side of a barn in Wisconsin is one of the largest mural paintings in this country. Edward and William Chapman, who operate a dairy farm near South Wayne, Wis., had the landscape painted on the wall facing the highway.



One-hundred-fifty-foot mural painting decorates side of a dairy barn

Daring Pilot Picks Flag off Ground with Wing Tip



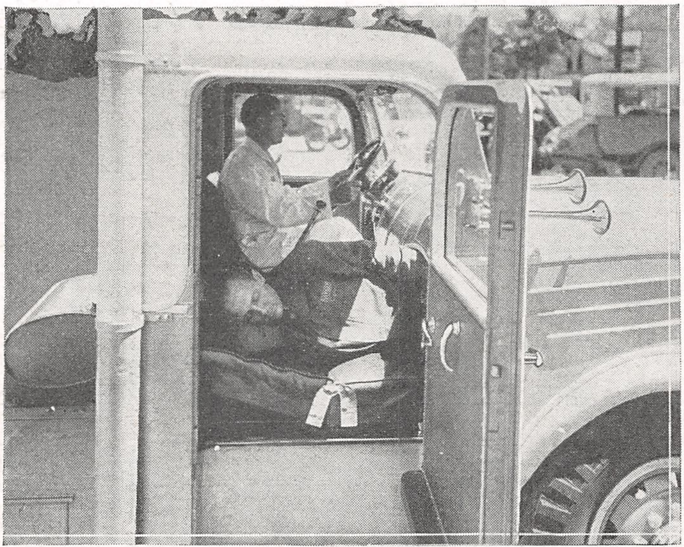
Remarkable photograph snapped just as tip of plane's wing picked small flag off the ground

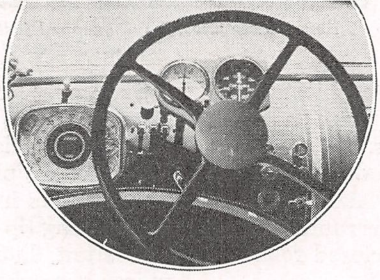
Skimming only a few feet above the ground, Henri Detroyat, daring French pilot, picks a flag off a two-foot mast with the tip of his plane's wing. The small flag or banner is impaled on a hook attached to the wing tip as the plane swoops down. The stunt, latest in crowd thrillers, requires remarkable handling of the plane because dipping the wing only a few inches too low would mean a crack-up.

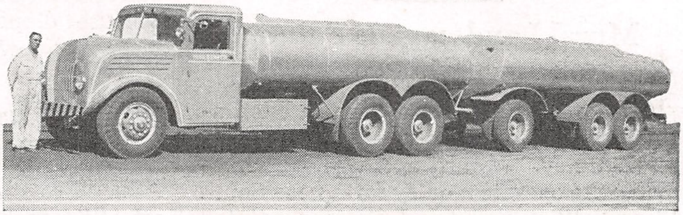
Killing Frost Helps the Farmer by Slaying Millions of Insects

Jack Frost is one of the farmer's strongest allies in his eternal fight against insects—how strong has just been revealed. When they examined an acre of fertilized soil on an English experimental farm, scientists found the ground normally contained about 106,000,000 insects. After a freeze, the insect population had been reduced by more than half to 40,800,000. In unfertilized soil the insects totaled only 25,600,000 after frost.

'Dust Bowl' Truck Has Air-Conditioned Cab







Co-pilot's seat in air-conditioned cab, shown at top, slides forward to become full-length bed. Tachometer, mounted with air-brake dial on dashboard, enables driver to obtain top efficiency from Diesel engine

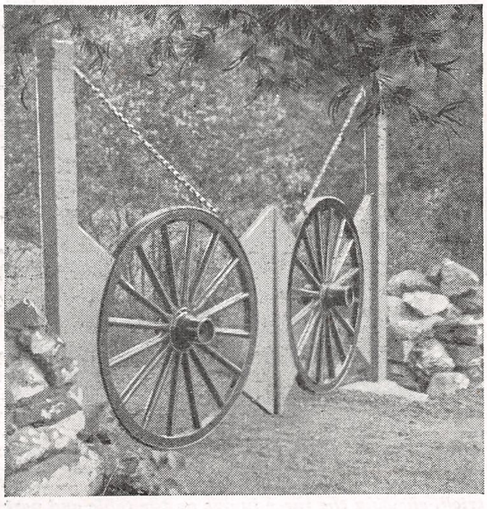
Not only the drivers but the Diesel engine itself breathes conditioned air in a truck built for travel through the "dust bowl" of Kansas and Colorado. Since comfort for the drivers during stifling dust storms was essential, a mechanical air conditioner was installed in the cab. A gasoline engine drives a two-cylinder compressor, and a tank holds fuel for a thousand-mile trip. The cooling element, sulphur gas, flows through coils in the cab, keeping its temperature at seventy-four degrees. The co-pilot's seat is convertible into a comfortable seven-foot bunk extending under the hood. The seat is made in three sections which slide on rails. To insure efficient operation of the Diesel motor, even through dust storms, three specially designed wet-air cleaners attached to the intake manifold filter the air thoroughly. On the dashboard, in clear view of the driver, are an air-brake dial and a tachometer which shows the pilot what his engine is doing regardless of miles per hour. This aids in obtaining the most efficient engine operation. There is a separate red hand on the tachometer which points to the highest engine speed attained during a trip and can be reset only by a special key belonging to the truck owner.

Coin-Operated Machines Sell Millions of Articles a Year

Millions of articles, with an estimated value of $500,000,000 per year, are sold by coin-operated machines in the United States. Nearly 500,000 people in this country receive full support and many thousands more partial support from the coin-machine industry. Among the articles sold in these automatic vending machines are cigarettes, amusement tickets, railroad tickets, stamps, pencils, phonograph records, bird seed, flowers, foods, and many others. In addition, the industry is responsible for thousands of coin-controlled weighing machines, phonographs, and pianos. In one year the industry purchased three million square feet of glass, ten million dry-cell batteries, twenty-six million feet of electric wire, millions of light bulbs, switches and electrical equipment, two hundred and forty million feet of lumber, thousands of tons of steel, aluminum, brass, chrome and metal products and thousands of gallons of paint, varnish and stain. The New York subway, in one year, sold 480,000 sticks of chewing gum, 108,000,000 sticks of chocolate and 6,240,000 pounds of peanuts in coin machines, at a retail value of more than $6,000,000. The industry is growing as more and more articles are adapted to sale in the machines.

Old Wagon Wheels Form Unique Gate

Two wagon wheels, survival of the horse and buggy era, form the picturesque gate to an estate at Middleton, Mass. Swinging on hinges, their weight is partly borne by chains hung from posts on each side of the driveway. The wheels are enameled bright red with black rims, the woodwork being cream colored.



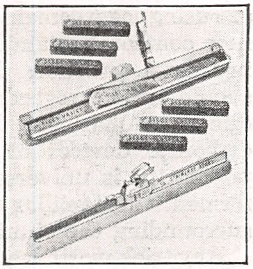
Wagon wheels swung on hinges form this charming gate to an estate in Massachusetts

Jail Is Turned into "Fortress" by Machine-Gun Guard Cages

Guard on duty in "fortress," ready to halt any attempted escape by inmates of jail. The cage is bulletproof

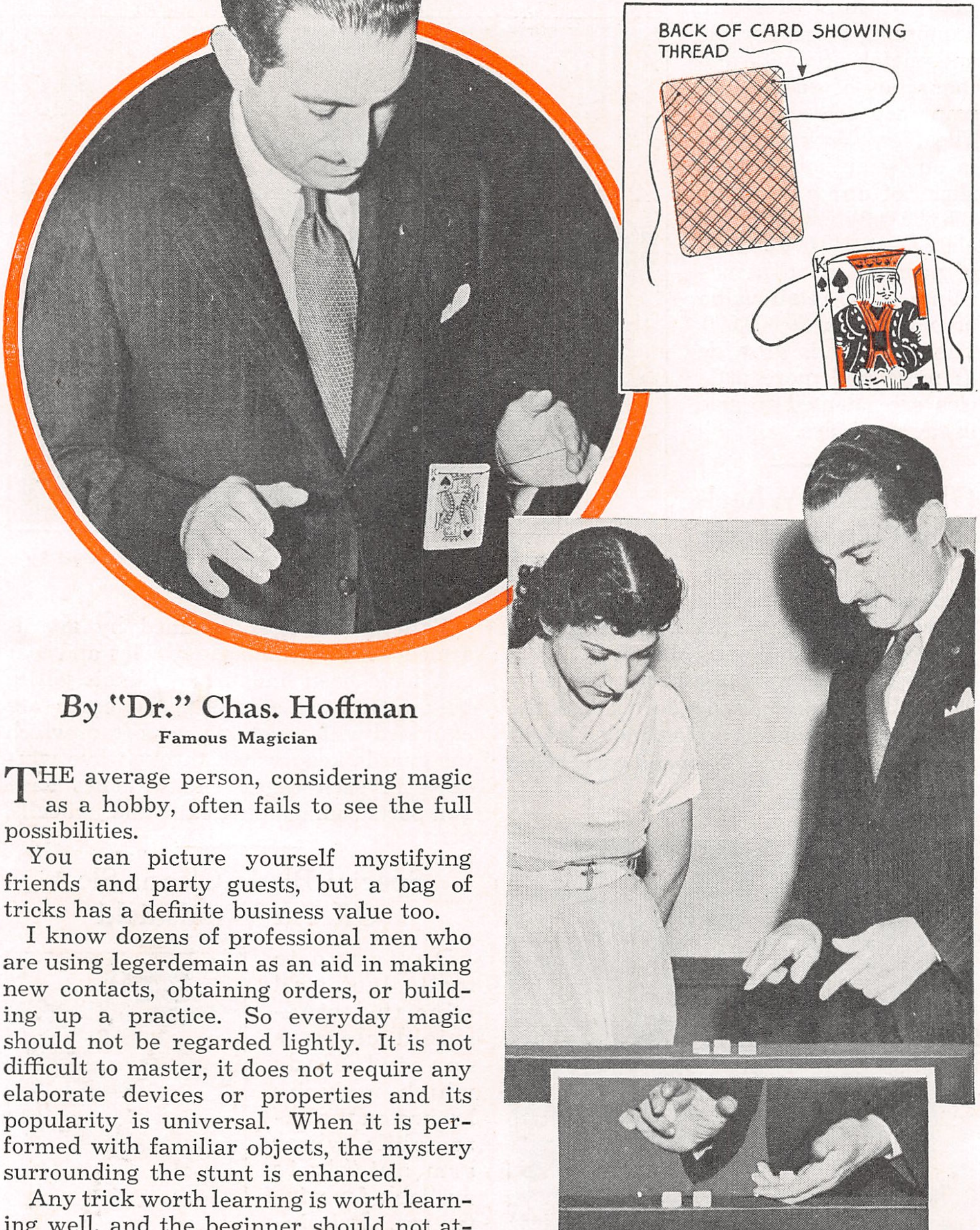
Bulletproof cages, manned by guards armed with machine guns, rifles and tear gas, have been built in an Illinois jail to balk attempted escapes. The cages are equipped with revolving seats from which the guards keep watch through five windows in each cage. The windows have gun ports commanding exits and jail cells.

Special Blade Cleans Sleet Off Car Windshield



Designed to melt sleet and wipe the windshield clean, a special blade which may be hooked on the automobile wiper arm quickly is available for winter use. It is intended only as a substitute for the rain wiper when sleet makes driving perilous. The device is entirely self-contained, requires no special connections and puts no load on battery or motor.

“MAGIC


BACK OF CARD SHOWING THREAD

Above, floating card trick, showing string on which card travels and close-up showing how thread is attached. Below, beginning of the sugar lump mystery trick, showing the three lumps on the table and part of the routine during which one lump is concealed between the second and third fingers

By "Dr." Chas. Hoffman

Famous Magician

THE average person, considering magic as a hobby, often fails to see the full possibilities.

You can picture yourself mystifying friends and party guests, but a bag of tricks has a definite business value too.

I know dozens of professional men who are using legerdemain as an aid in making new contacts, obtaining orders, or building up a practice. So everyday magic should not be regarded lightly. It is not difficult to master, it does not require any elaborate devices or properties and its popularity is universal. When it is performed with familiar objects, the mystery surrounding the stunt is enhanced.

Any trick worth learning is worth learning well, and the beginner should not attempt the presentation of a trick in public until every movement in the routine is polished. The more expert the actions, the greater the effect upon the audience. It's the manner in which a trick is presented

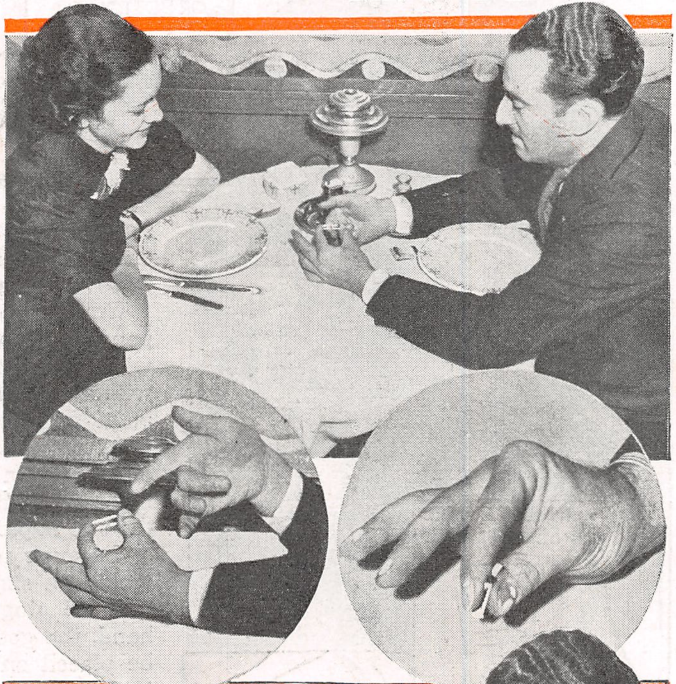
PAYS DIVIDENDS"

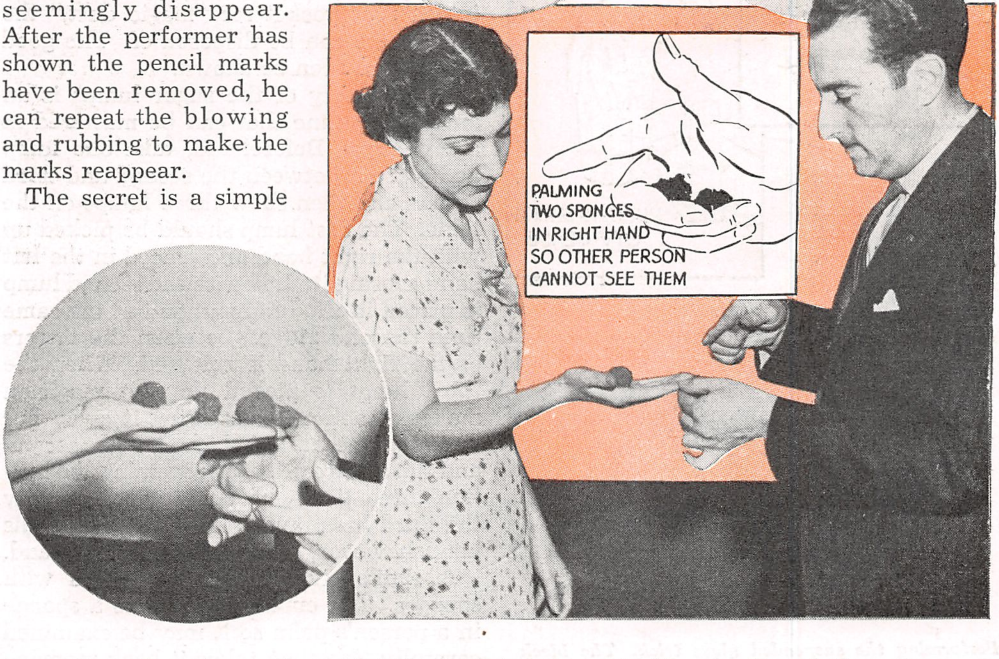
that determines its success, not the trick itself.

Many amateurs work themselves into a lather putting over a trick and then destroy the fruits of their labors by supplying an explanation of their methods. A magician should never tell the secret of a trick because it will immediately kill the interest in it.

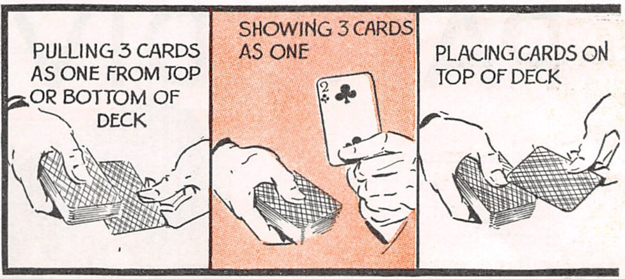
Match tricks are always good for a laugh and the one illustrated is one of the best. Two paper matches are shown with pencil marks on one side of each. Then by blowing on the matches and rubbing them with the thumb, the pencil marks seemingly disappear. After the performer has shown the pencil marks have been removed, he can repeat the blowing and rubbing to make the marks reappear.

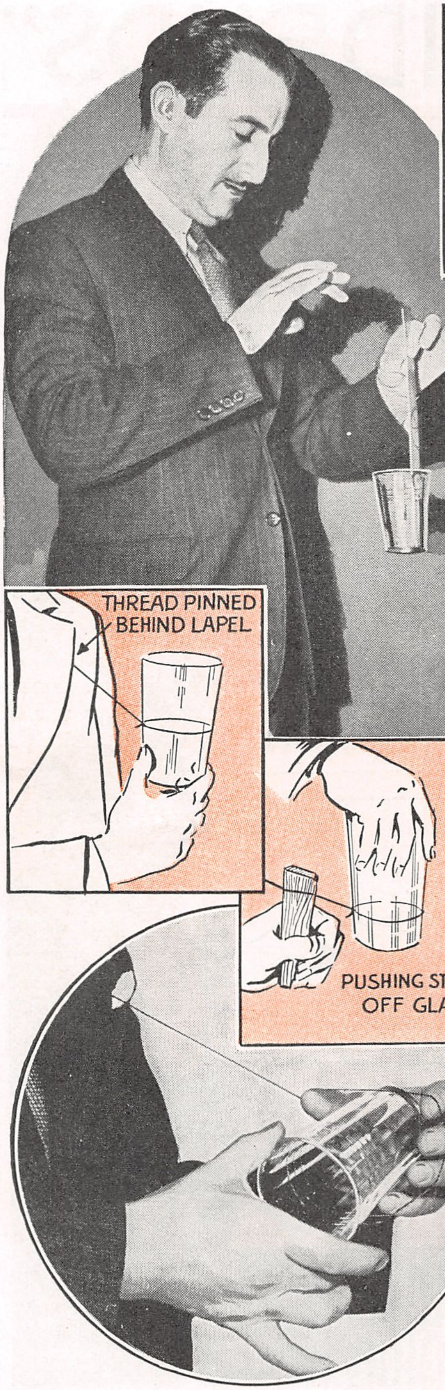
The secret is a simple





Above, three steps in the match trick. A twist of the wrist while going through the motion of rubbing and blowing on the matches turns them to expose either the marked or unmarked sides. Below, the sponge trick involves palming two spare sponges in the hand while exhibiting one. The sponge being shown is then also palmed. When the hand is opened three sponges appear—and you are the hero of the evening


PULLING 3 CARDS AS ONE FROM TOP OR BOTTOM OF DECK
SHOWING 3 CARDS AS ONE
PLACING CARDS ON TOP OF DECK



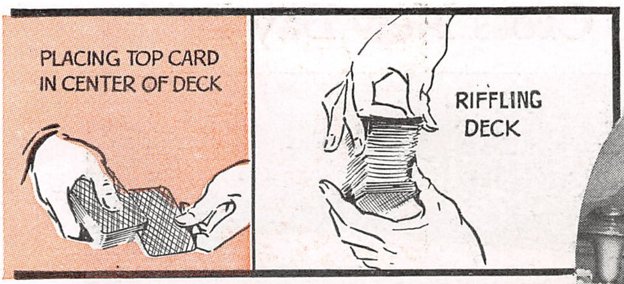
Performing the suspended glass trick. The black thread attached to the coat lapel cannot be detected a few feet away and the glass apparently rests unsupported in midair. A glass containing ridges on the outside works best for this trick but an ordinary tumbler can be used

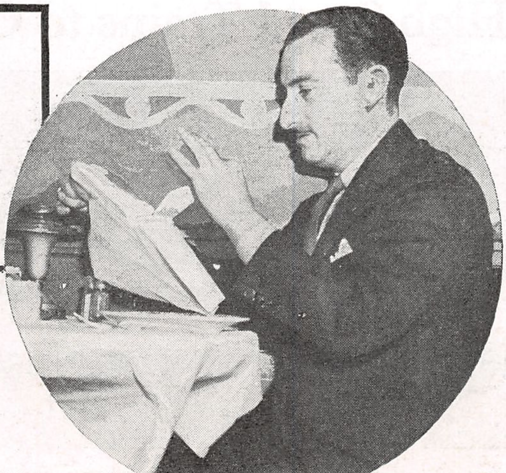
twist of the fingers. The twist is made either with blowing or as they are turned to cover the movement.

Would you like to be able to tear up a paper napkin, wad the pieces, then unwind the ball, showing the napkin to be without a single tear? Before starting, palm an untorn wadded napkin in the right hand so it cannot be seen. Tear the other napkin into pieces and roll into a ball, placing it in the right hand also. Then the two napkins should be grasped tightly and shown to the audience as one. By making a slight turn with the left hand and bringing them back into the right hand, the good napkin will automatically be placed on top. On the ruse of going into a coat pocket for "magic dust," the torn pieces can be disposed of. The good napkin can then be shown.

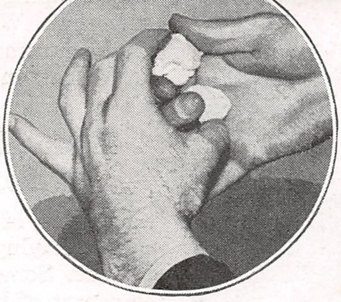
The mystery of the sugar lumps is an amusing routine that can be mastered in a few days. Beforehand, take one lump and place it between the second and third fingers and then show three lumps on the table. The first lump should be picked up with the right hand and placed in the left hand, closing it. Likewise the second lump is placed in the left hand and at the same time the one hidden between the fingers of the right hand is released. When the third lump is picked up, the magician makes a motion of throwing it away but doesn't, concealing it between the second and third fingers. After repeating the motion three times, he actually does throw the third lump away. When he opens his hand, however, three lumps may be found.

A similar trick may be worked with sponges. The entertainer places a sponge in a person's palm so it may be examined carefully. He then takes it back momentarily and returns it to the person's palm, asking him to squeeze it tightly. When the palm is opened, three sponges will


PLACING TOP CARD IN CENTER OF DECK
RIFFLING DECK



Above, the secret of this card trick rests in pulling three cards as one from the deck. Photos show steps in the amusing paper napkin stunt



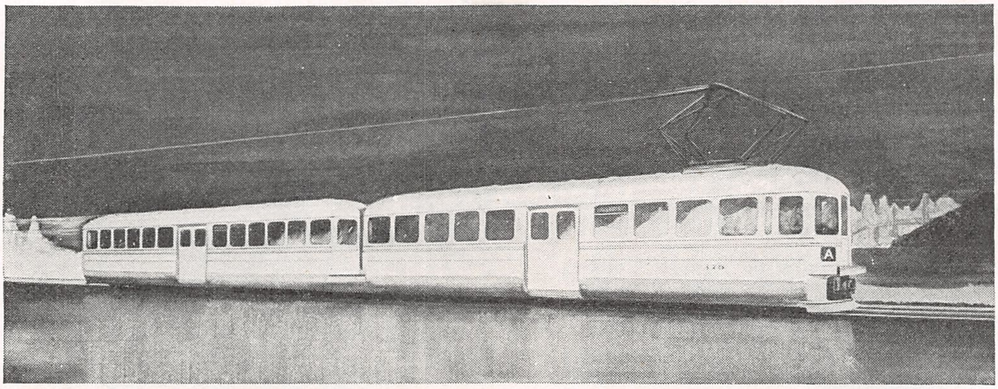
appear. This stunt is effected by finger-palming two sponges in the right hand. Upon completion of the examination of the first sponge the magician places it between the thumb and forefinger of his other hand, thumb on the bottom. Then he grasps the three sponges and places them in the other person's palm, supposedly as one.

A mysterious but simple card trick also is shown. From the top of the deck, three cards are taken as one. The top card is then shown to be, say, jack of diamonds. These cards are placed on top of the deck and the jack of diamonds is supposedly placed somewhere in it. In reality it is one of the other cards. The deck is then riffled and the jack of diamonds is shown on top, this time the two cards being lifted as one. The stunt may be repeated in the same manner, thus disposing of the second "indifferent" card.

With the aid of a few cents' worth of materials, you can perform the suspended glass stunt. This is particularly suited for a banquet or some other place where the magician has a little space between himself and his audience. At the outset, call for an ordinary water glass and fill it three-quarters full of water. Then holding an ordinary foot rule at the

(Continued to page 154A)

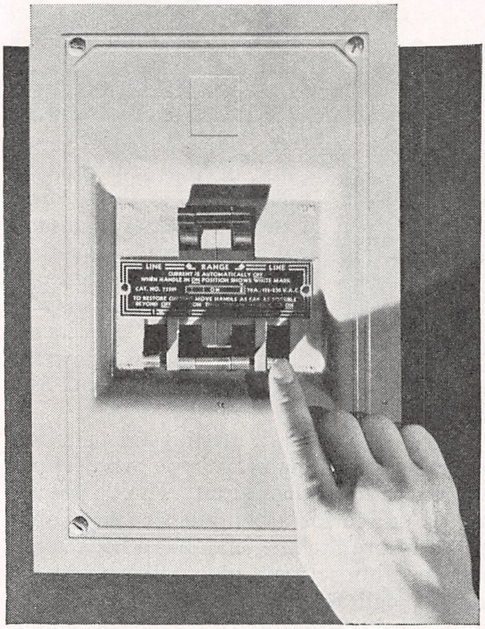
High-Speed Trains to Cross New Bay Bridge



Two-car articulated electric train designed for the interurban service between San Francisco and the cities at the other end of the new bay bridge. The unit can be coupled to another train while in motion

Articulated two-car train units geared for seventy miles an hour are being built for the heavy interurban traffic that will cross the new San Francisco Bay bridge when the rails are laid in 1937. The two cars are mounted on three roller-bearing trucks with electric automatic couplers for joining or uncoupling units while in motion. To insure safety the motorman's cab will have both visual and audible signals, besides the railside signals, and automatic controls will halt the train if the motorman fails to heed warnings. On the bridge, the trains will draw 600 volts from a third rail, while on land power will be drawn through pantagraphs.

Inexpensive Circuit Breaker for Home Eliminates Fuses


LINE
RANGE
LINE
CURRENT IS AUTOMATICALLY OFF WHEN HANDLE IN ON POSITION SHOWS WHITE MARK

This simple device eliminates fuses and attendant troubles in home electrical circuits

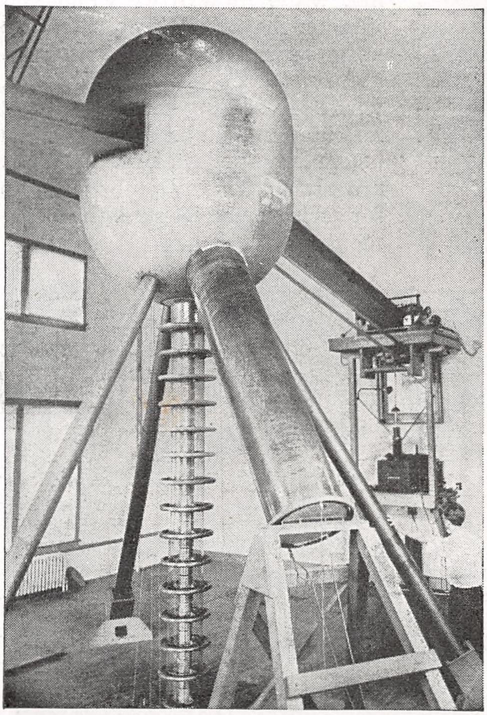
Inexpensive to install, a simplified circuit breaker for the home electrical system eliminates fuses. The device protects the system from overloads by automatically tripping a contact bar and breaking the circuit. When the cause of an overload has been removed, the handle may be reset to the "on" position.

Living Improved by Metals from Electric Furnace

Creation of metals in the electric furnace is playing an important role in everyday life. Some things which have come to be a part of living because of the special new materials which the electric furnace has made possible are aluminum cooking utensils, tungsten filament electric lights, electrically heated home appliances, automobiles, radio and airplanes and dirigibles. The electric furnace makes possible large scale production of steels whose quality outrivals that of the famous Damascus blades. The annual output of stainless steel is valued at $50,000,000, and the trend is rapidly upward. Within ten years, the electric furnace has brought about revolutionary advances in the shaping of extraordinary hard metallic materials, such as tungsten carbide. The manufacture of these substances into cutting tools and dies and other special products required the electric furnace. Costs of gasoline and of the automobile it propels have been minimized by use of super-hard electric furnace alloys for oil-well drills and for metal-working tools.

New Elements Made from Old by Huge Atom Smasher

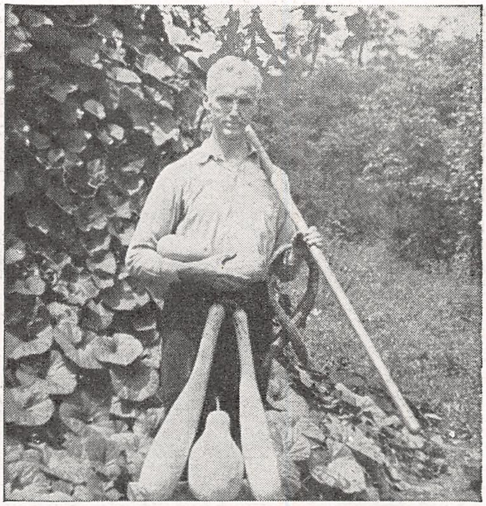
Carnegie Institute scientists are building a giant atom smasher that will make new elements from old. The atom is stripped of its electrons and projected at violent speed against another atom by a 1,200,000-volt X-ray tube. When they collide, the atoms are so displaced that one element is transformed into another of entirely different atomic composition.



© Harris & Ewing

Breaking down atoms and creating new elements is the task of this 1,200,000-volt machine

Strange Vegetables Grown by City Business Man

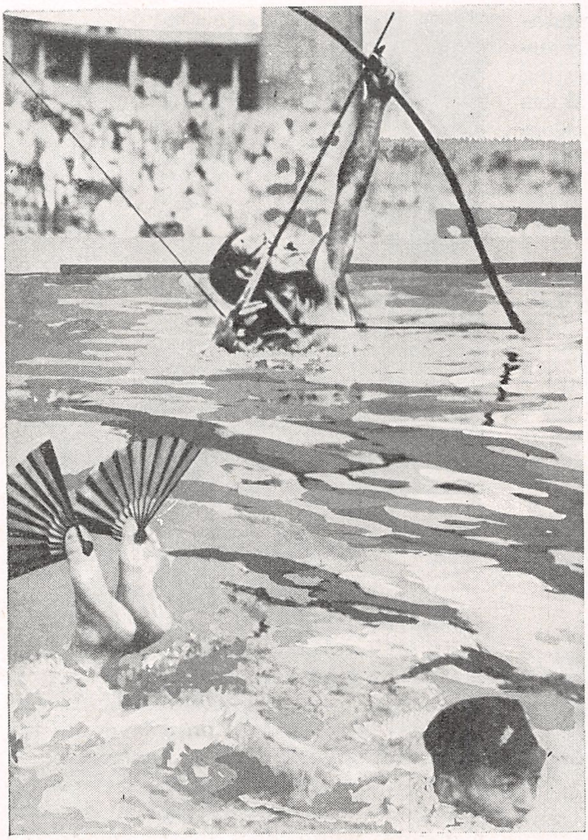


Gardener with snake cucumber over left arm, spaghetti fruit in right hand and butter plant below

Albino tomatoes and tree-climbing squash are among the odd varieties of fruit and vegetables developed for the market by a business man at Washington, D. C., who is a spare-time gardener. His products have brought new flavors to the American table. His giant Japanese black radish, attaining weights from fifteen to fifty pounds, has a velvet black skin and a creamy white meat that is hot to the tongue. Used as a salad garnish, it can be preserved for long periods by burying it in earth. The gardener introduced Persian spaghetti fruit, a squash shaped like a small watermelon and having an "oriental" flavor. By carefully selecting and cross-breeding varieties of yellow tomato he produced a pure white tomato. Another squash type is the New Guinea butter plant, a vine which climbs lattices and trees and develops a very tasty small squash. Snake cucumber, also new to American vegetable growers, bears fruit that curls with a remarkable resemblance to a serpent. Seed for these plants is available now, and some are so hardy that they require neither fertilizer nor watering.

ℂOur Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

Feats of Ancient Japanese Taught to Modern Swimmers



Japanese practicing centuries-old stunts of shooting arrow at target and keeping fans going with feet while swimming

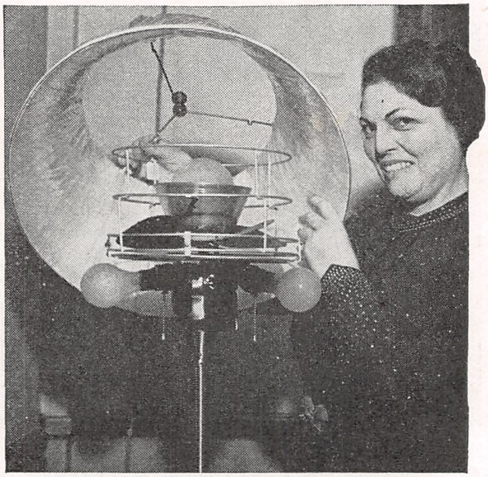
Swimming stunts handed down through the centuries are still taught to young swimmers in Japan. One of the ancient feats was to shoot an arrow from a bow while in deep water, this trick requiring extreme discipline and practice if any accuracy is developed. Another stunt is to wield a fan out of water in each foot while swimming.

Water-Skating Sport Seen as Due to Invention

With a pair of water skates on which a patent has been granted, the wearer can stand upright on the surface of the water and by shuffling his feet, he can walk or skate. The skates are made of rubber and inflated with air. They assume the shape of miniature sailboats, keel and deck, except that there are no sails or rigging. Instead, on the "deck" of each skate is mounted a holder in which the foot is strapped. Deck and keel of the skates are made of metal and are embedded in the rubber. The inventor claims the keel, which cuts into the water like the blade of an ice skate into ice, gives the skates stability and reduces the tendency to sideslip.

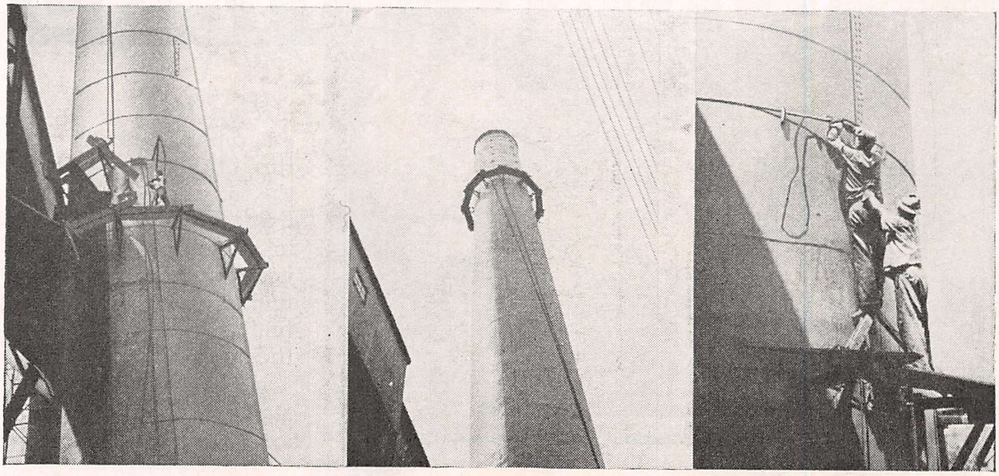
Floor Lamp with Sun Rays Has a Hidden Fan

Electric fan, light and health lamp in one is the latest style of floor lamp for the home. Peer underneath its shade and you discover a horizontally mounted fan, protected by a wire guard. It can be used either to heat or cool the room, for on warm summer days it merely keeps the air circulating, while in winter when you turn on the infrared bulb the fan keeps warm air moving through the room. The infrared lamp, which is used for heat therapy, is mounted in a metal cup at the top of the lamp pedestal, and below it are ultraviolet ray bulbs suitable for giving artificial sunlight treatments.



Floor lamp equipped with fan and sun-ray bulbs

Stage Hung from Cable Encircling Chimney

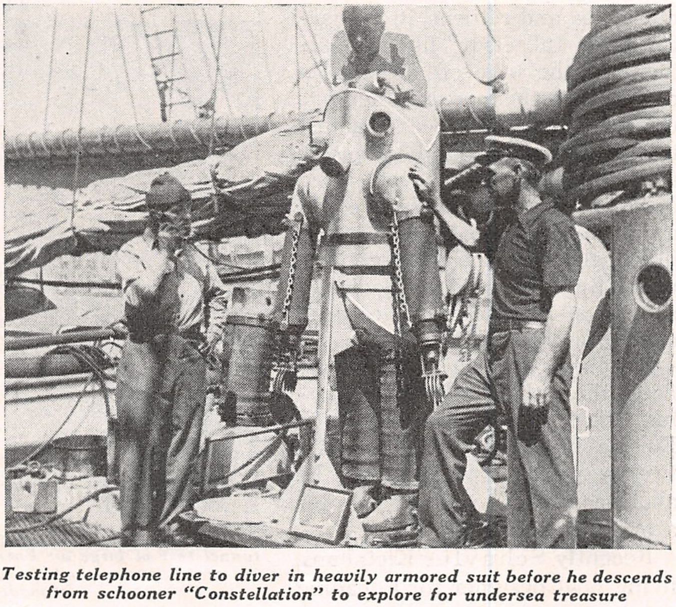


Three views of the painters' scaffold hung on a cable embracing the chimney, showing, at left, and right, method of changing elevation, and in center the cable by which men reach the ground

Instead of building a scaffold that would have required a carload of lumber and six weeks labor, workmen repairing and painting a 300-foot chimney scaled it on a platform hung from a single horizontal cable encircling the chimney. The stage itself consisted of brackets and planks hooked to the cable. It was raised eight feet at a time by attaching an alternate cable equipped with a turnbuckle to which the platform was gradually lifted and hooked. The lower cable then was retrieved and fastened eight feet higher. Changing the elevation took only fifteen minutes. The painters applied one coat on the way up and another on the way down.

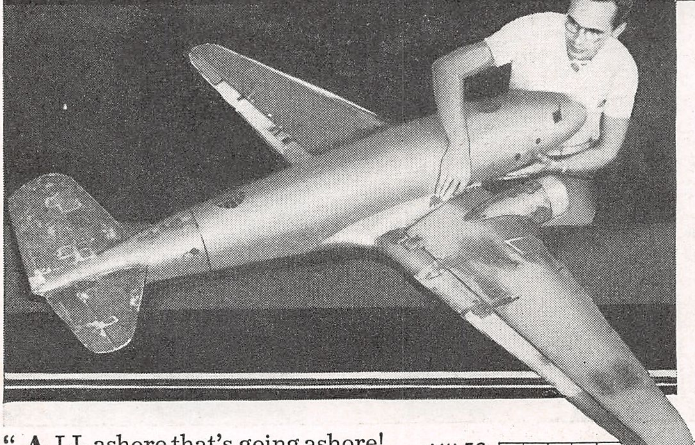
Divers in Submarine Armor Seek Silver on Sunken Ship

Heavily armored diving suits were given a thorough test aboard the old four-masted schooner "Constellation" before it put to sea recently in search of sunken treasure. The massive diving uniform was equipped with the latest apparatus for undersea work. The treasure ship sought by Capt. Alvin Loesche and his divers, James Collom and Roy Hanson, was believed to lie on the ocean floor off Cape Charles with $1,700,000 in silver bullion, jewels of the Queen of Spain, valuable mahogany timber and 3,000 cases of rum aboard.



Testing telephone line to diver in heavily armored suit before he descends from schooner "Constellation" to explore for undersea treasure

FUTURE TITANS



"ALL ashore that's going ashore! The ship flies in five minutes!"

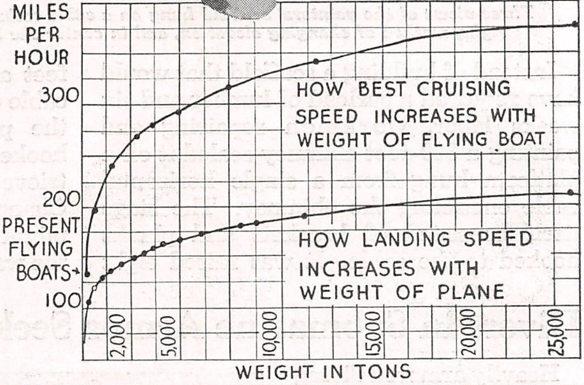
From your porthole four decks above the water you watch the last of the 500 passengers come aboard the plane. Sea doors clang shut, lines are cast off, and the captain's pouch containing last-minute mail is drawn up from the wharf. A faint throb indicates that the engineers in the wing are speeding up the engines.

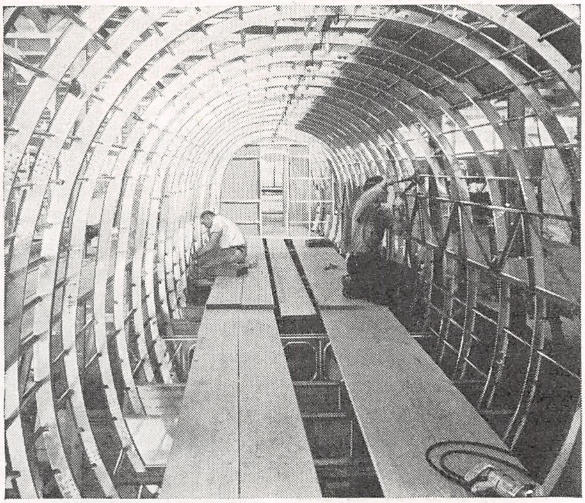
A small policing plane dashes out to sea and returns, its powerful green "all clear" light signaling that the take-off course is clear. Then the monster liner gets under way. Spray beats against the portholes as the boat plows along to attain its take-off speed of 170 miles per hour. In two and a half minutes the 1,500-ton titan lifts itself out of the water and the navigating officer is methodically setting a course for London, eleven hours away.

It sounds fantastic, but engineers think that you will be buying tickets for a one-day ride to Europe in such a giant within twenty years. The fare will be about as little as you pay now for a middle-class cabin.

Recently Schuyler Kleinhans, flying boat designer for a leading aircraft firm, assembled on graphs a technical picture of the flying boats of the future. He knew that flying boats are doubling in size about every five years and he wanted to find out what practical limits there might be to their growth.

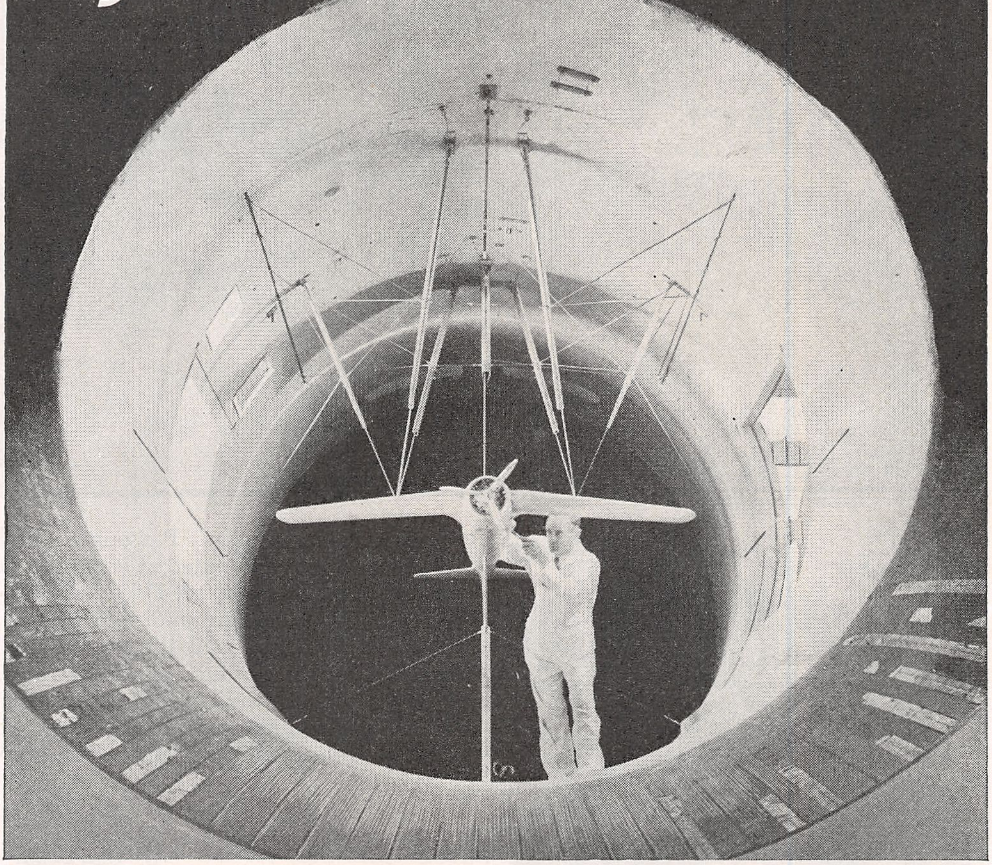
His conclusions are startling. Using accepted aeronautical laws, he





Top, changing shape of wing fillet with modeling clay for wind-tunnel test of large air liner. Center, how cruising and landing speed increase with weight. Bottom, assembling fuselage of modern air liner

# of the SKIES

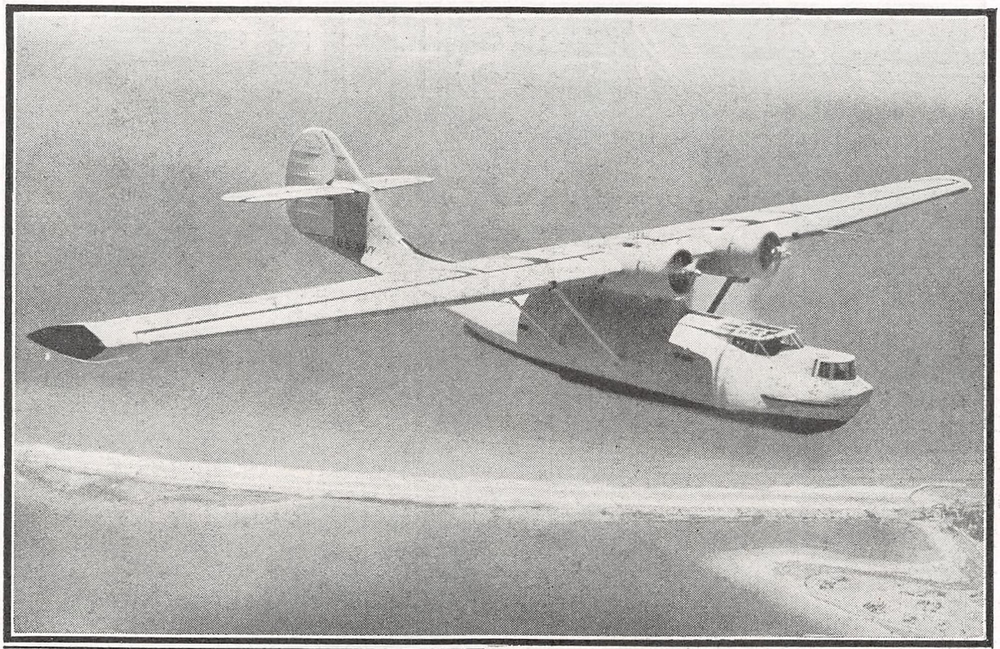


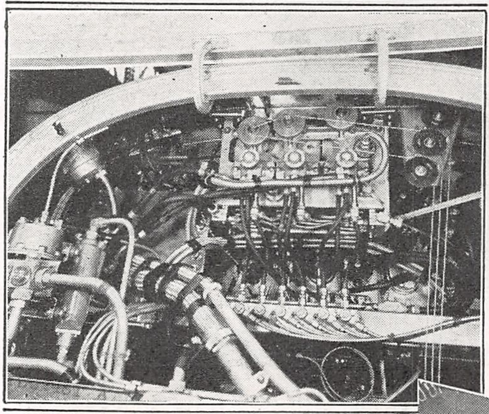
Designer testing model of new air liner in wind tunnel. Here he finds proof that his design is airworthy or he discovers that changes must be made at various points on the model

found that huge flying boats are not only possible but will be more efficient than the ones we have now, even without considering probable improvements in materials and engineering technic. To give a concrete picture of the future flying boat he assembled data on a type sixty times heavier than our present airplanes.

This 1,500-ton colossus of the air would weigh about the same as a modern destroyer. Its 200,000-horsepower plant is approximately the same as that of the "Queen Mary" or the U. S. S. "Saratoga." The hull would be 375 feet long and the monoplane wing would be 550 feet long. The wing would be sixteen feet high, leaving plenty of room inside for engines and engineers. The boat would have a cruising speed of 300 miles per hour at 10,000 feet altitude and it would need a run of nearly five miles to get into the air. The hull would be of modified "V" design to help absorb the landing shock and the boat would need three-quarters of a mile in which to land. The cost would be about $20,000,000, about half the price of the "Queen Mary."

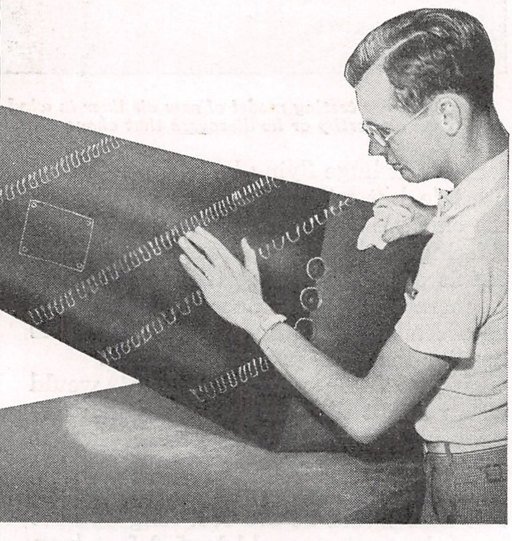
The tail alone would weigh more than a modern transport. Kleinhans figures that the tail group would weigh forty-five tons. The wing would weigh 165 tons, the hull, which would have to be strong



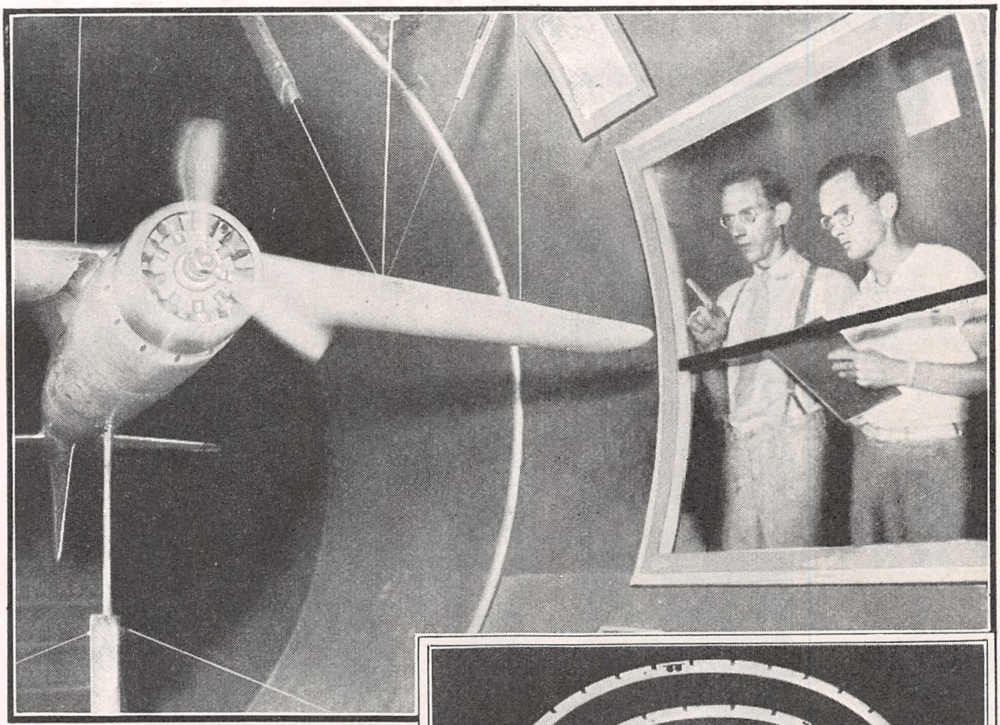


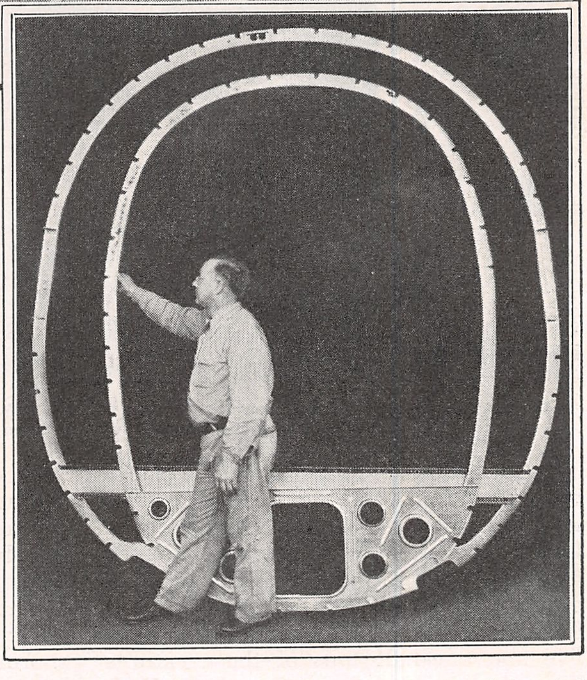
enough to smash through seas at 170 miles per hour, 150 tons, the power plant, 300 tons, and fixed equipment such as interior furnishings, another ninety tons. This places the total empty weight of the boat at 750 tons and allows a useful load of the same weight, of which about a third, on a long ocean crossing, would be pay load.

Fuel and oil for one trip amount to 500 tons, and twelve and one-half tons are allotted for the crew. It would take 100 people to operate the boat and take care of the passengers and the crew could live on board permanently. Passengers and their luggage are estimated at sixty-seven and one-half tons, leaving 170 tons available as cargo, including mail and express matter. With a full load the boat would have a cruising radius of 4,800 miles, enough to cross the Atlantic non-stop with a very comfortable reserve. The boat would be able to fly 7,000 miles non-stop



Top, big navy flying boat. Center, wiring system of latest air liner. Bottom, loose strings on wing flutter when model reaches stalling angle in wind tunnel





Top, engineers studying model plane being tested in wind tunnel. Note spinning propeller which is electrically driven. Bottom, how planes grow—a comparison of old transport cabin frame with that of new Douglas sleeper transport

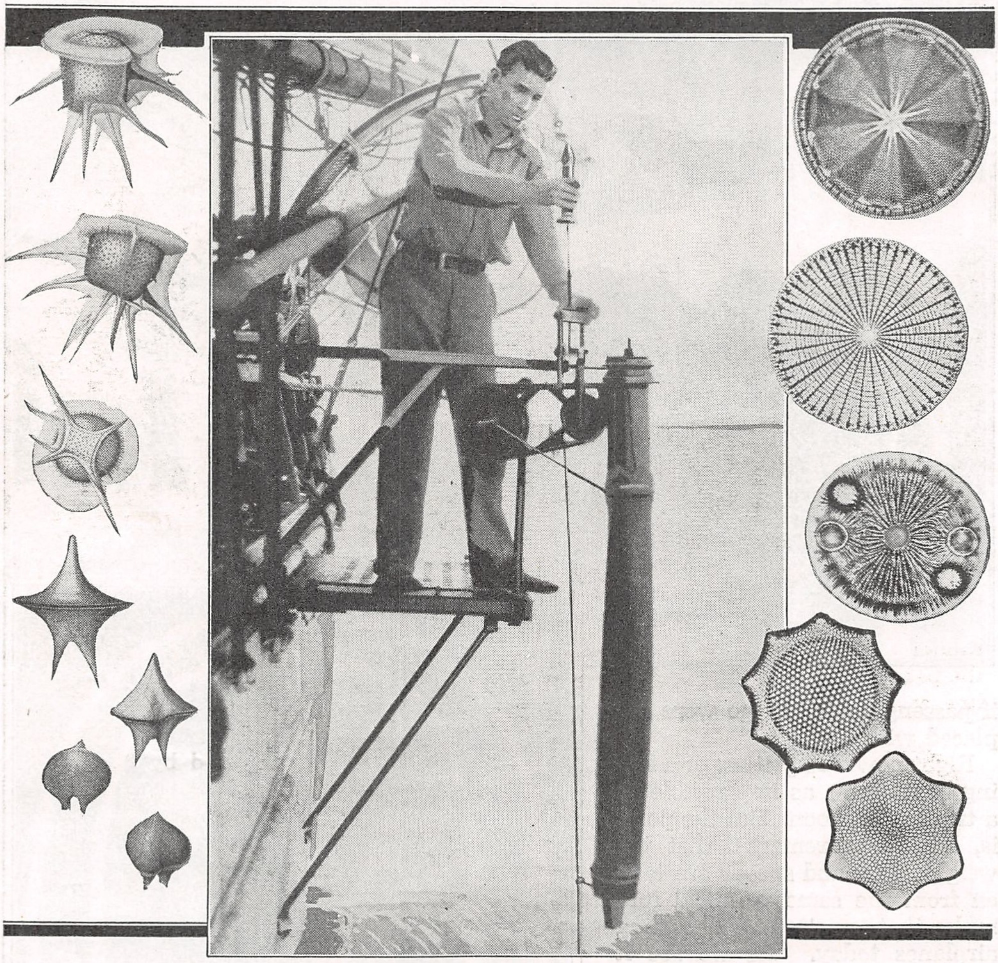
if passengers and cargo were replaced with fuel.

Right now this picture of a flying boat seems as implausible as a trip to the moon. But the point is, Kleinhans remarks, that the weights, lifts and speeds are taken from the same practical formulas that are used for designing airplanes today. "As we see it now the flying boats of the future will be simple geometric enlargements of our present types together with any minor improvements that may be developed," Kleinhans states. "Actually, an efficient boat in the 1,500-ton class could be built at once if the demand existed."

Large commercial planes are faster than small ones. This is explained in one basic formula. Doubling the size of a plane multiplies its resistance four times and its weight eight times. To carry this weight, eight times as much power is required but since the resistance is only increased four times, the plane can fly faster. Doubling the size results in an increased speed of twenty-six to thirty per cent.

(Continued to page 116A)

Tiny One-Cell Diatom Is Real Wonder-Worker

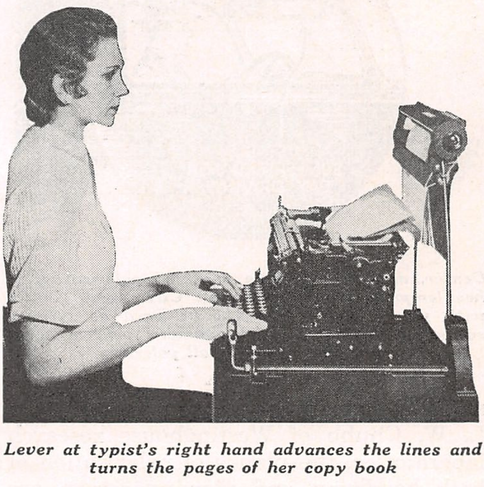


Center, equipment for taking sample of sea water in which may be found new kinds of diatoms. On either side are magnified views of diatoms. Note the beauty of shape, particularly of those at right

So small that 500 of them could be placed on the head of a pin, the one-cell diatom is a real wonder-worker. Scientists have found 8,000 species of the diatom. In one-half a day, the tiny creature can produce another like itself and within one year from this original diatom may be born five and one-half tons of the creatures beneath one acre of water surface. Each one is only one one-hundredth of an inch in diameter. Yet it is able to take chlorophyl, the green coloring matter found in plants, add sunshine and combine carbon, oxygen, nitrogen, phosphorus and other inorganic substances into food. The diatoms, having combined these things in their own bodies, are eaten by copepoda, sardines, clams, oysters and other marine creatures. These are eaten by fish and the fish by man. The millions of diatoms which escape their natural enemies sink to the bottom of the ocean after their short life and their tiny skeletons form enormous beds, in the course of ages. In Lompoc, Calif., these diatom skeletons cover an area of twelve square miles to a depth of 1,400 feet. This earth is valuable for polishing and grinding surfaces where a high luster is desired. It is absorbent and is used in making dynamite. It is good for filtering varnishes, oils, sirups and other heavy liquids. Road builders are beginning to use diatom-made earth in making concrete roadways. Alive, the diatom stores up oil in its body, from five to forty-five per cent of its body being oil. When it dies, this oil is released to collect with the oil from countless millions of other diatom skeletons. Eventually it becomes the crude oil from which gasoline, candles, perfumes, medicine, flavoring and many other things are made. The diatom's various shapes, a perfect circle, an oval, an ellipse, a crescent, and other forms with gracefully curved outlines, are so faultlessly executed and accurately proportioned that attempts have been made to copy them for mural decorations, jewelry designs and textile patterns. Scientists often call the diatom the "grass of the sea" because it is the fundamental food on which so much animal life depends.

Pages of Notebook Turned by Hand Lever

Time and effort are saved the stenographer by a notebook holder which turns the page at the mere touch of a lever. The line of copy being transcribed is always directly in the line of vision, a stroke of the hand moving the line up the desired space and turning the page when the bottom is reached. Press a button and the copy holder folds away into the desk.


Lever at typist's right hand advances the lines and turns the pages of her copy book

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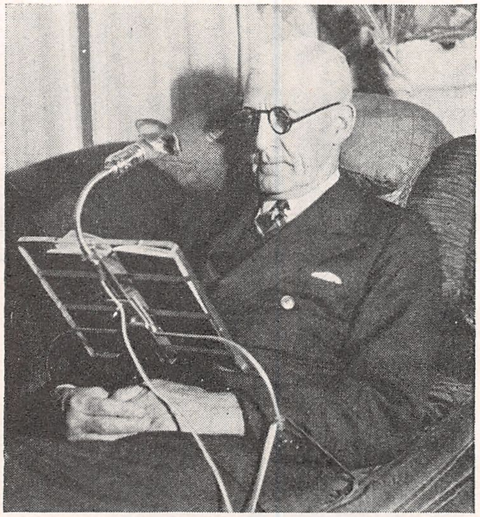
Molasses is mixed with surface soil in India to produce wear-resisting highways.

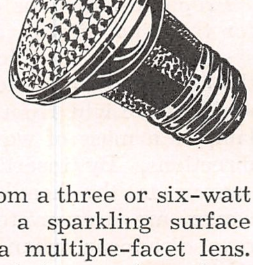
Book Rest with Own Light Adjusts to Suit Reader


Handy book holder has its own lamp. Rubber "fingers" hold book open at place desired

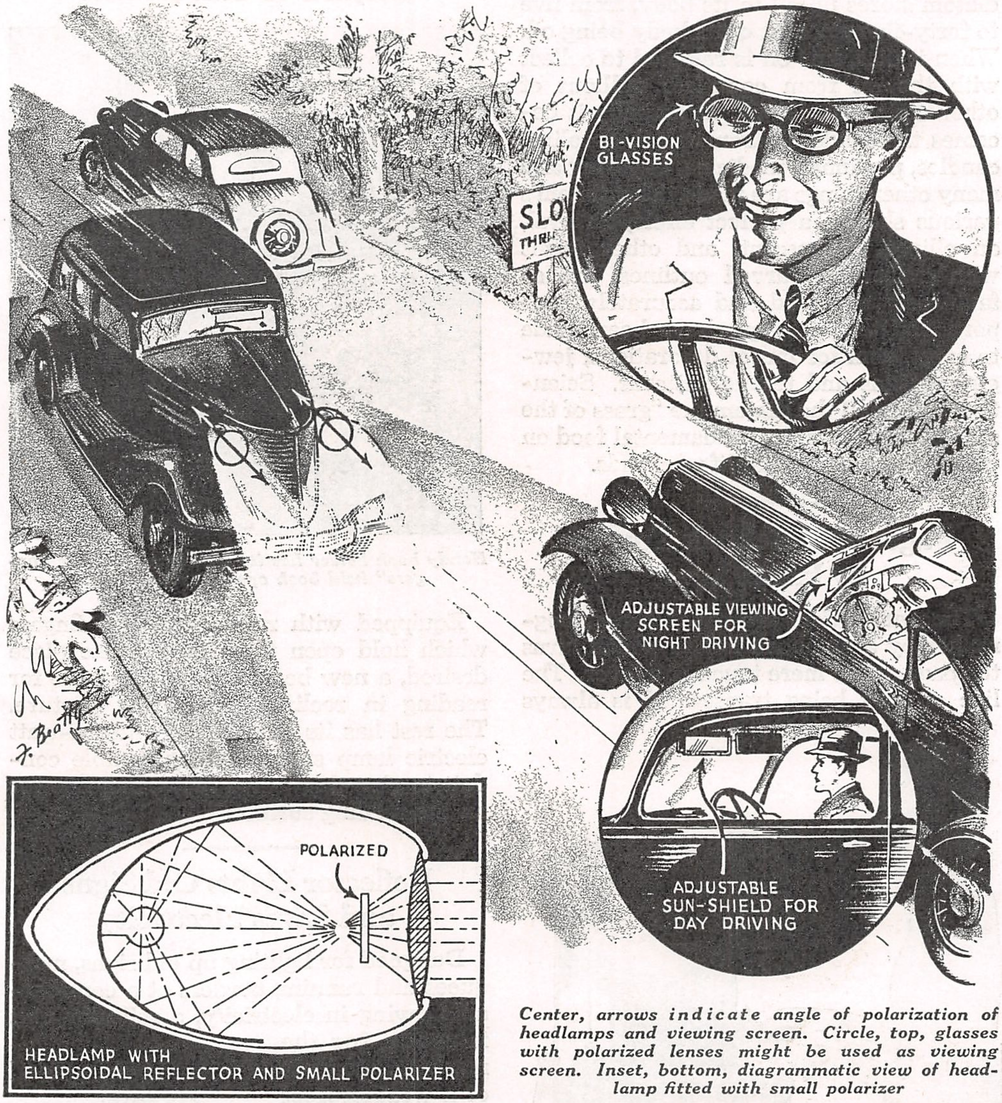
Equipped with rubber-covered fingers which hold open the pages at the place desired, a new book rest is adjustable for reading in reclining or sitting posture. The rest has its own light, a fifteen-watt electric lamp suspended by flexible conduit to give thirty-five foot-candle power on the reading surface.

Reflector Lights Old Signs and Saves Electricity

Designed for lighting up old signs, marquees and running borders at a considerable saving in electricity, a reflector unit is ready for the market. It consists of a weatherproof reflector molded into a standard brass ferrule that can be screwed into any standard light socket. The polished aluminum reflector intensifies the light from a three or six-watt bulb and produces a sparkling surface brilliance through a multiple-facet lens. The system is intended to replace those now using ten or twenty-watt bulbs.



Polarized Lighting System for Safer Driving

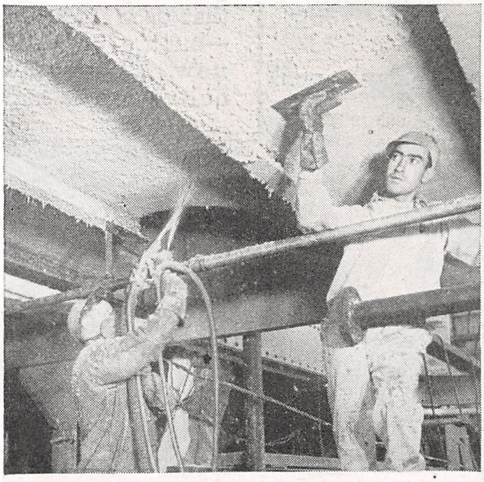

BI-VISION GLASSES
SLO
ADJUSTABLE VIEWING SCREEN FOR NIGHT DRIVING
ADJUSTABLE SUN-SHIELD FOR DAY DRIVING
F. Beatty
POLARIZED
HEADLAMP WITH ELLIPSOIDAL REFLECTOR AND SMALL POLARIZER

Center, arrows indicate angle of polarization of headlamps and viewing screen. Circle, top, glasses with polarized lenses might be used as viewing screen. Inset, bottom, diagrammatic view of headlamp fitted with small polarizer

Proposed as means of increasing safety for the night driver, a polarized lighting system for motor vehicles would eliminate the blinding glare which frequently causes accidents. Light from an ordinary headlamp is a mass of waves vibrating in all directions. By inserting light-polarizing screens in the headlamps only parallel waves are transmitted. These selected rays disappear when viewed through a similar transparent screen whose plane of polarization is at right angles to the transmitted rays. In the system proposed by L. W. Chubb of Westinghouse research laboratories, the planes of polarization of both headlamp and viewing screen are arranged at forty-five degrees to the horizontal. Because the viewing screen and headlight coincide optically on each car, the driver obtains a maximum of reflected light from objects illuminated by his lamps and by lamps on cars traveling in the same direction. For cars going in opposite direction, the planes of polarization will be perpendicular to each other and the rays from an opposing lamp will be stopped by the viewing screen, eliminating glare. The system calls for the use of larger light bulbs, an inexpensive polarizing screen in each headlamp and a third screen for the driver. Existing equipment could be changed to the new system, but to be effective all cars should be fitted with the headlamps and viewing screen.

Asbestos Insulation Applied to Walls with Spray Gun

Asbestos insulation in colors to match your decorating scheme can be applied with a spray gun to ceiling, walls, or even to pipes. Applied like paint, it adheres readily to metal, wood, cement, brick or plaster, providing a fireproof surface that conserves heat and aids in soundproofing. A square foot of the sprayed asbestos an inch thick weighs only six to eight ounces, thus no additional supports are needed to carry its weight on the ceiling.



Applying a coat of asbestos on walls and pipes

Ship Built in Oklahoma Hills Starts for Alaska on Trailer

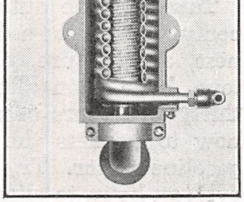
OKLAHOMA to ALASKA

From the wooded hills of Oklahoma this cabin cruiser traveled on a trailer to Seattle to be launched for a coast-line voyage to Alaska

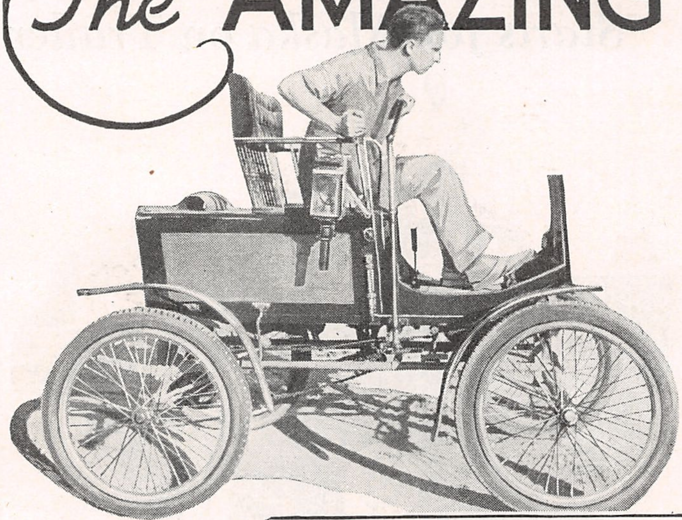
Woodsmen in the hill country of Oklahoma who had never seen a boat constructed a twenty-seven foot cabin cruiser in which four men made a land-and-sea voyage to Alaska. Their boat made the first 2,300-mile stage on a trailer. At Seattle it was launched for the Alaskan cruise.

Heater Warms Water in Car for Winter Starting

Designed to make starting easier in winter, a hot-water circulator for the automobile engine will keep the motor warm in an unheated garage. An electrical element which applies heat to a coil warms the water in the water jacket and radiator of the car. Thermosyphon action set up by heating the water causes circulation through the cooling system, carrying warmth to all parts of the engine. Use of the device reduces winter starting time.



The AMAZING STORY



"THE most important story of this century," the man said slowly, "is told by these."

He pointed to twenty-five ancient vehicles lined up before the green background of an orange grove.

The man was Lindley Bothwell, who owns a ten-acre orange grove near Los Angeles.

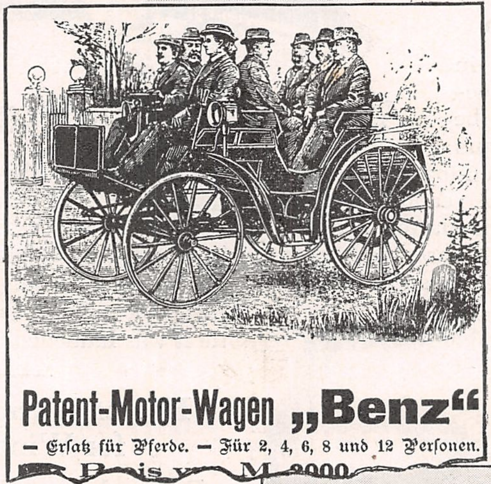
What he pointed to was the family tree of the auto—a collection of ancient power-driven vehicles, which he has assembled during five years of painstaking search. His oldest "auto" is vintage 1899.

And what he said is true.

Take out the auto, and the twentieth century would be a different thing. Business, architecture, psychology, art, even love, have been altered during the last thirty-five years because man discovered how to harness the explosive power of gasoline vapor. Try for one day, or for even an hour, to eliminate the automobile from your life, your thoughts, and your speech. It is almost impossible.

The modern, streamlined, finger-tip-controlled auto came up through the same relentless process of evolution as do living things. It had its monstrosities, its missing links, its abortive branches that died out leaving no descendants, its trends and reversals of trends. There is no more thrilling story than the process by which the auto marched on over a thousand mechanical and psychological obstacles. And this assembly of cars tells that story better than a thousand volumes could do.

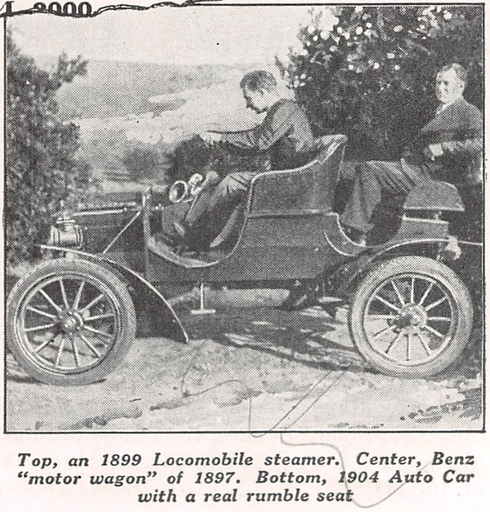
This collection of autos is the story of something that changed a civilization. In the dim corridors of museums are endless gatherings of things that once mattered—but are long dead now. This man's collection is still



Patent-Motor-Wagen „Benz"

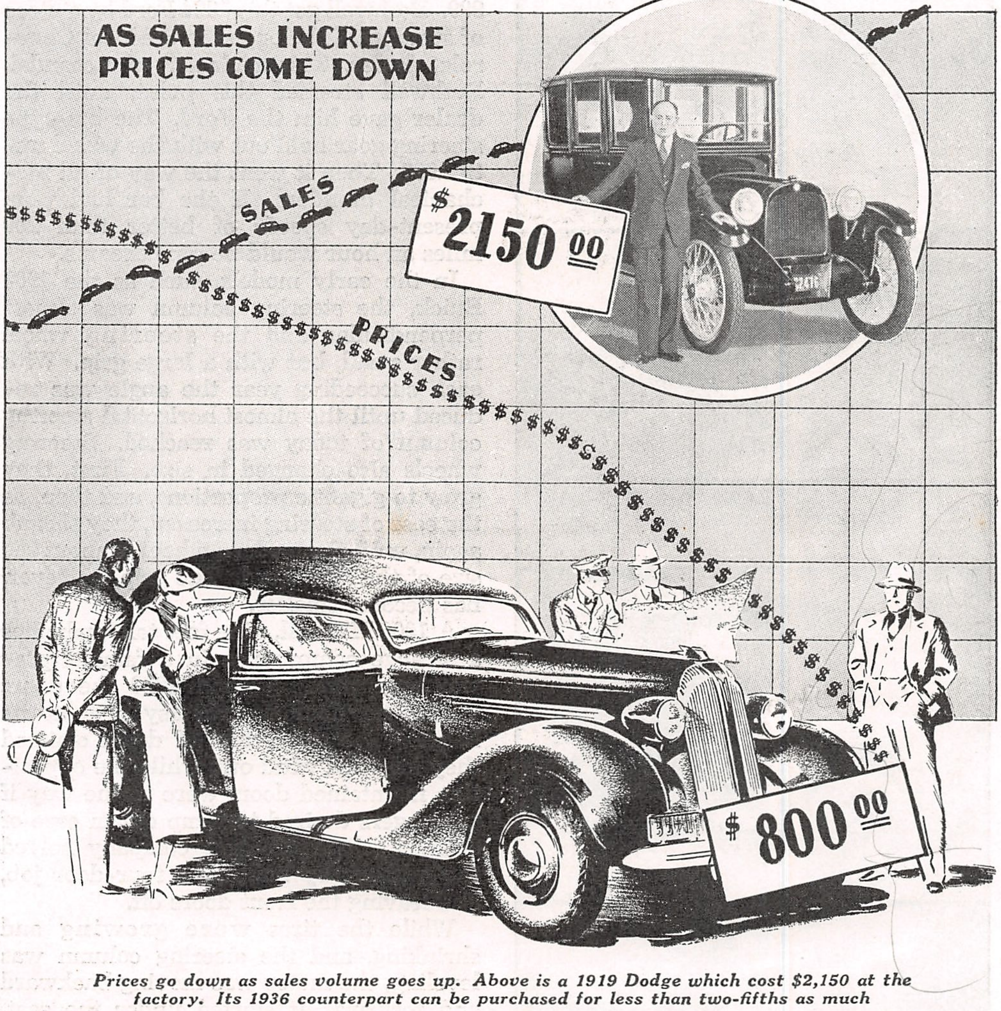
— Erſatz für Pferde. — Für 2, 4, 6, 8 und 12 Perſonen.

P is v M 2000



Top, an 1899 Locomobile steamer. Center, Benz "motor wagon" of 1897. Bottom, 1904 Auto Car with a real rumble seat

# of the AUTOMOBILE



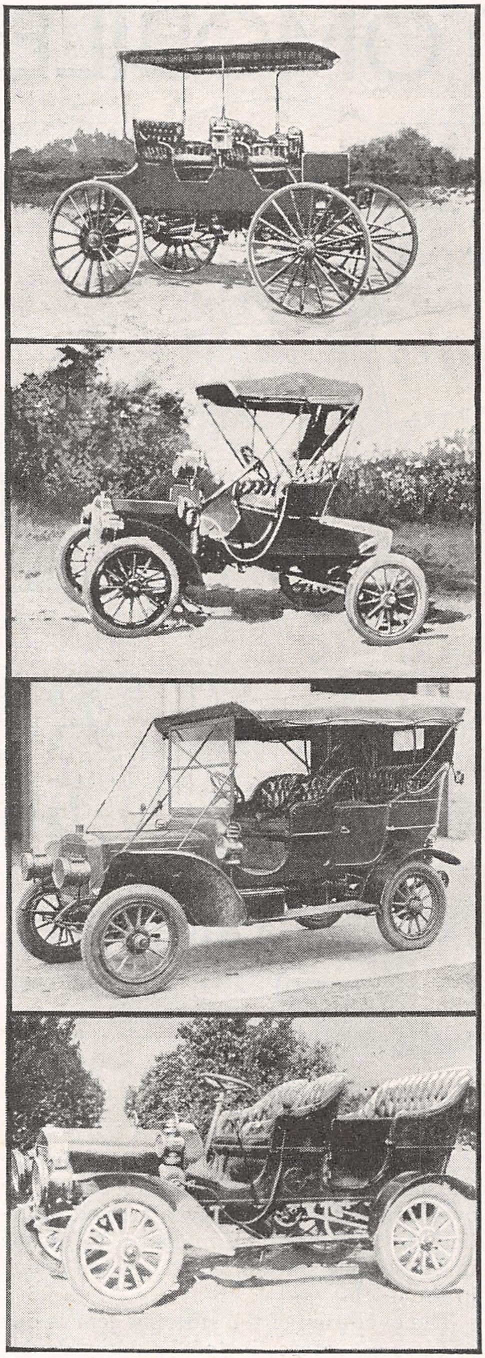
Prices go down as sales volume goes up. Above is a 1919 Dodge which cost $2,150 at the factory. Its 1936 counterpart can be purchased for less than two-fifths as much

living, still vital in our lives. This fact is typified by the condition of the cars. They all run. They chug, wheeze, and put on one, two, or four cylinders, but they go. That is the only regulation. His cars must go from his ranch to the center of Los Angeles on their own power. That is the final test, after each car has been painstakingly rebuilt.

Of course, his arbitrary test sometimes causes confusion. One Sunday afternoon the owner was taking a 1906 Oldsmobile on her test voyage. The Oldsmobile steered with a horizontal bar. A woman driving a big sedan became so interested in the Oldsmobile that she forgot to steer her own car. The Olds' driver tugged frantically at the bar, and managed to escape into a service station, but the sedan ended in the ditch.

The evolution of the steering gear is one of the most interesting of the many developments illustrated by the collection. It starts with a 1900 Sears which has a horizontal bar with a big ball on the end. Perhaps the ball was meant to serve as a lightning rod. It hasn't any other purpose.

By 1904 the wheel-type steering gear



Top to bottom, a Sears turned out in 1900 with iron-tired wheels, a Ford which came off the assembly line in 1904, a Mitchell of 1906 which was nine feet tall and a Buick which was all the rage in 1904. Mechanical evolution has gone a long way since these cars were built

was beginning to come into its own. One of the earliest steering wheels in the collection is on a Ford bearing engine number 2017. The original Ford was number 999. Bothwell got this 1904 Ford by a piece of strategy. It belonged to the local Chevrolet dealer. This made sort of a scandal. Bothwell stressed this point, until the dealer gave him the Ford. The bar-type steering gear held out with the wheel until 1907. Then it went the way of all mechanical blunders. If the bar had won, present-day speeds of better than 200 miles an hour would be pipe dreams.

In the early models, such as the 1905 Buick, the steering column was almost perpendicular and the steering wheel rather small, but with a large grip. With each succeeding year the angle was reduced until the almost horizontal steering column of today was reached. Steering wheels also changed in size. First, they grew to gigantic proportions, and then, as the ease of steering increased, they shrank again, until the modern wheel is about the size of the 1904 Ford. The grip, however, has become smaller.

A 1906 Mitchell, nine feet tall, embodies a strange compromise in a famous prewar argument. Around 1910 the doors versus no door controversy was at its height. The supporters of doors claimed they kept the wind out, while the opposition maintained doors were in the way if passengers desired to jump out in case of accident. The Mitchell company solved the problem by building a four-door job, and leaving the front doors off.

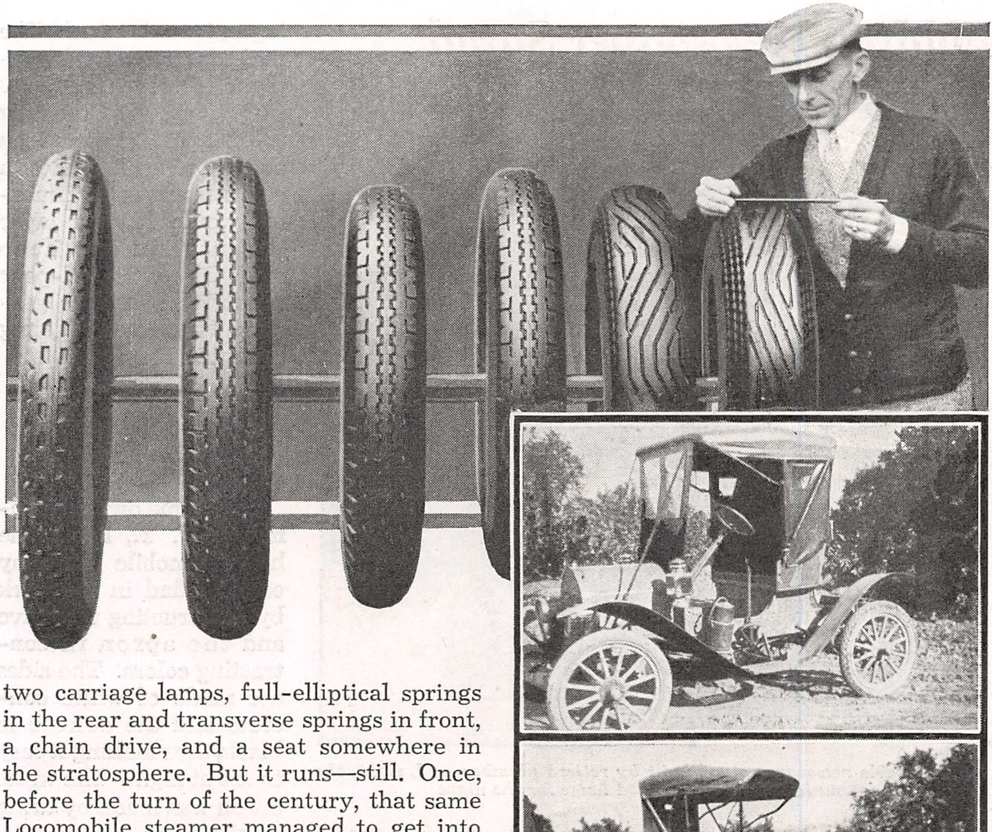
While the tires were growing and shrinking, and the steering column was leveling, the motor was moving backward and forward. It started under the seat, then came forward under the hood. Once or twice it made another trip to the rear, as in the case of the 1905 Buick which has the engine under the seat and the gas tank under the hood.

Just before the turn of the century, another type of power-driven vehicle saw the light of day. It came with great expectations, fresh from the proving ground of the railroads. It was the steamer. This is represented in Bothwell's collection by a "thing" of the vintage of 1899. It looks like nothing of this world. It has the body of a hybrid buggy, the wheels of a bicycle, two carriage lamps, full-elliptical springs in the rear and transverse springs in front, a chain drive, and a seat somewhere in the stratosphere. But it runs—still. Once, before the turn of the century, that same Locomobile steamer managed to get into Yosemite National Park. Up the grades, over the rutted wagon roads, it climbed—somehow.

Standing beside the steamer is a representative of that other vanished race, the electrics. There are two electrics in Bothwell's collection. One is dated 1907 and the other 1916. They were once hailed as the ultimate in smooth and speedy transportation. The 1916 model represents the high tide of its species. It is an enclosed model, originally selling for $2,000. Almost a ton of batteries are stored inside its frame. Its maximum speed was twenty-five miles per hour.

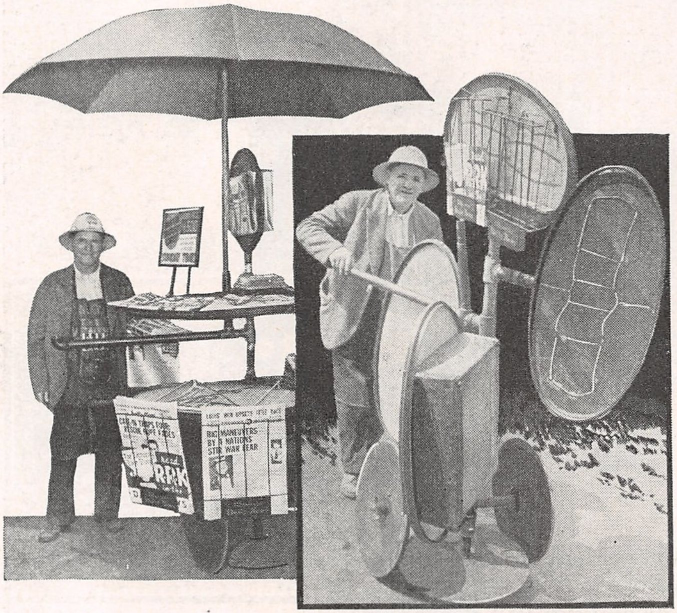
Not long ago Sir Malcolm Campbell set a world's land speed record at Salt Flats, Utah. He reached a speed of more than 300 miles per hour. The great, great grandfather of his Juggernaut is stored in the huge barn where Bothwell keeps his collection. It is a 1908 Overland racing car. It once roared through the dust of the old Corona race track, sixty miles from Los Angeles. However, the speed record

(Continued to page 118A)



Top, evolution of the tire from the high-pressure era to the low-pressure age. Tire at left carried eighty pounds pressure while the one at the right holds more air but needs only sixteen to twenty pounds of pressure. Below, top to bottom, a 1907 Buick, a 1901 Oldsmobile and a 1902 Stanley steamer

Folding Newspaper Stand Is Wheeled Home at Night



Left, portable newspaper stand built by retired plumber, and, right, the stand folded up to be rolled home for the night

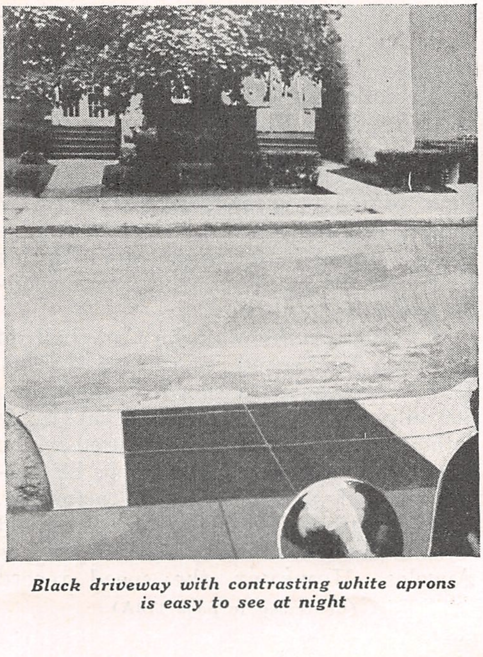
From plumbing to newspaper vending was an overnight step for a Los Angeles man. When he retired from the plumbing business at sixty he piped together a collapsible newspaper stand. With plenty of display space for newspapers, both vertical and horizontal, it is protected by a huge umbrella.

High-Priced Gasoline from Coal in Prospect When Oil Is Gone

When America has burned up its oil resources and turns to coal for fuel, gasoline may cost three times as much as it does today. The Bureau of Mines has already installed a plant for converting coal into gasoline, but this method is thrice as expensive as refining crude oil. Experts differ on the life of our visible oil supply, but Dr. Arno C. Fieldner, chief of the technologic branch of the bureau, says a compromise estimate points to exhaustion of the proved oil resources in fifteen years. After that, coal hydrogenation may become the economical method of producing automotive fuel. The nation's present oil supply would cover the 41,000 square miles of Ohio only three-quarters of an inch deep, while the known coal resources in America would form a layer seventy-six feet deep over Ohio. In oil-poor countries, synthetic gasoline is already being produced from coal.

Driveway Is Easy to Find in Dark

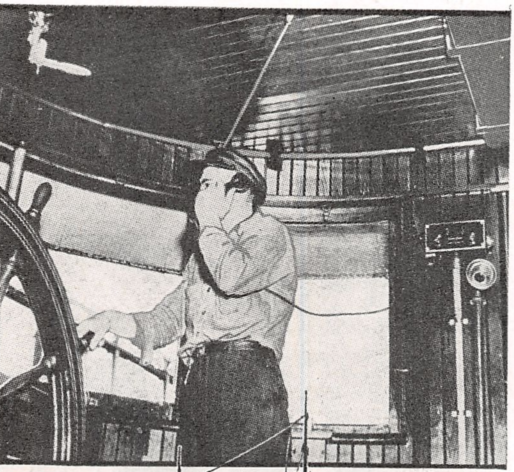
One home owner in Jamaica, N. Y., has made his automobile driveway easy to find in the dark by constructing the drive and the apron in contrasting colors. The sides are made of white concrete and the center is black, thus making it easy to see at night. The white apron was made by using white cement and light-colored aggregate. The black concrete was made by adding lampblack to regular concrete.

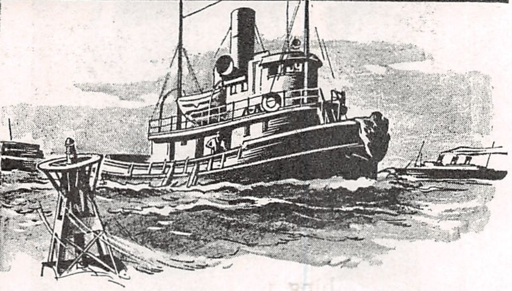


Black driveway with contrasting white aprons is easy to see at night

Freight Boats Talk on Harbor Radiophones

Seven freight boats operating in New York harbor have been equipped with two-way Western Electric radiophones to test the possibilities of regular radiophone service for commercial craft. Two-way conversations between the vessels and their dispatchers ashore may be carried on day or night. Connections can be made to any land telephone when desired. The shore equipment consists of a 400-watt short-wave transmitting station on Staten island and a receiving station with facilities for inter-connecting the radio voice waves with the telephone company's land wires. Low-powered five-watt sets are aboard the seven boats, five of which are tugs. Plans for radiotelephone service in the harbor have been under way for several years and the transmitting station now in use was erected by authority of the federal radio commission. Installation of the service has been delayed, however, pending experiments with simplified equipment which includes an improved method of calling the boats. Selective signaling apparatus is used, a telephone bell ringing on the vessel being called, thus eliminating the confusion experienced under the old system of loud-speaker monitoring when the ship crew had to listen constantly for the ship's particular signal.



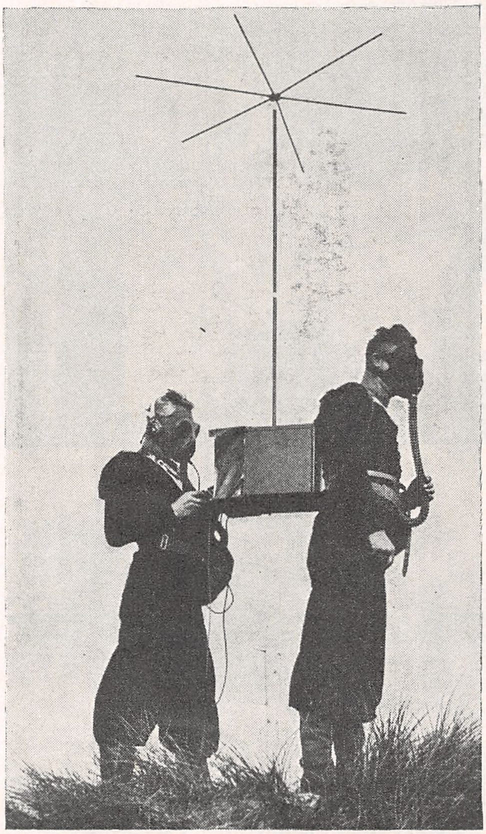


Two views of radiophone in use on commercial craft in New York harbor. Simplified system permits two-way conversations between the boats and dispatchers ashore. Both land and boat radio transmitters and receivers operate on short wave, five-watt sets being used afloat

Mysterious Noises under Sea Heard Off Pacific Coast

Strange noises coming from under the ocean have been reported recently by scientists of the U. S. coast and geodetic survey while they were making electrical soundings off the California coast. The "click-click—thud-thud" was heard at regular intervals every day during the survey expedition. No explanation of the phenomenon has been made.

Invading Sailors in Gas Masks Carry Radio Transmitter



Wearing gas masks, two sailors of a landing party in English war games carry two-way radio

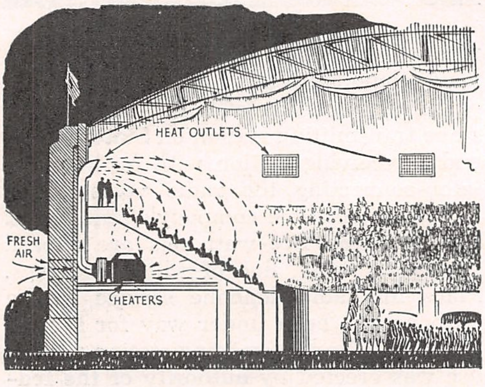
Playing at "war" on the English coast, a landing party of sailors representing the invading enemy donned gas masks and went ashore at Studland Beach near Swanage, to be met by a small defending party of British soldiers. The sailors carried a portable radio transmitter with a self-contained receiver to maintain communications with their supporting navy.

Spark-Plug Racket Ended by Court Order

Protection of the public against the sale of reconditioned spark plugs as new ones is afforded in a recent federal court ruling. This decision enjoins the sale of reconditioned spark plugs unless all identifying marks of the original plug are removed completely, the appearance changed, the shell and bushing painted red and plainly marked "used." Thus the buyer may see for himself whether the plug is reconditioned by noting whether hexagonal face of the shell bears the word "used." The court points out that the wholesaler may not intend fraud in supplying dealers with reconditioned plugs, but that the result is the same if dealers sell the plugs as new goods. If a lower price than that of new plugs is asked, with the buyer assuming that the merchandise is new, unfair competition with spark-plug manufacturers then exists, the court ruled. The decision is regarded as an important step in eliminating the spark-plug racket.

Giant Furnaces in Coliseum to Warm Spectators

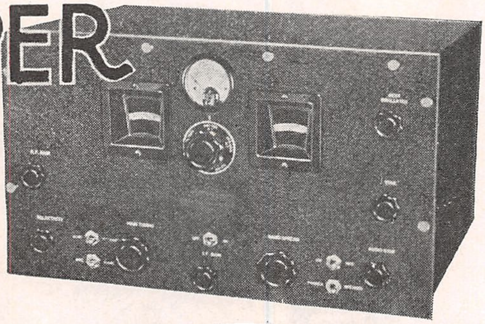
Designed to keep 7,000 spectators warm without heating the arena, a large furnace system will be installed in the municipal coliseum at Fort Worth, Tex. Sixty-five giant furnaces, capable of generating more than twelve million British thermal heat units from 12,500 cubic feet of natural gas per hour will be arranged in seventeen batteries spaced around the structure. The heating units will be located beneath the seats. Large ducts will carry warm air from the furnaces to the rear of the top row of seats where it will be forced downward over the audience. Then the warm air is drawn back into the heating system through vents beneath each row of seats. Meanwhile the arena will remain cool.



Showing where heaters and outlets will be located to keep spectators warm

Radio

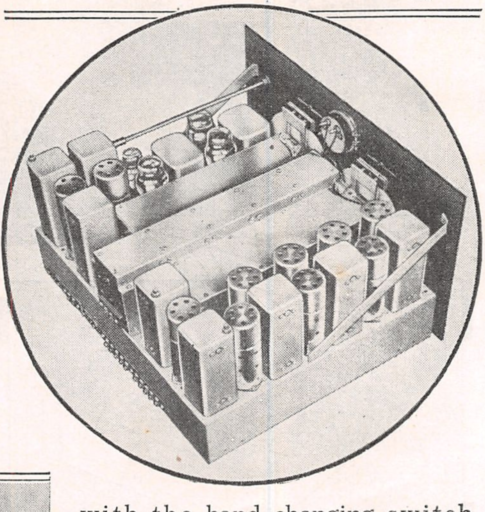
All-Wave SUPER DeLuxe

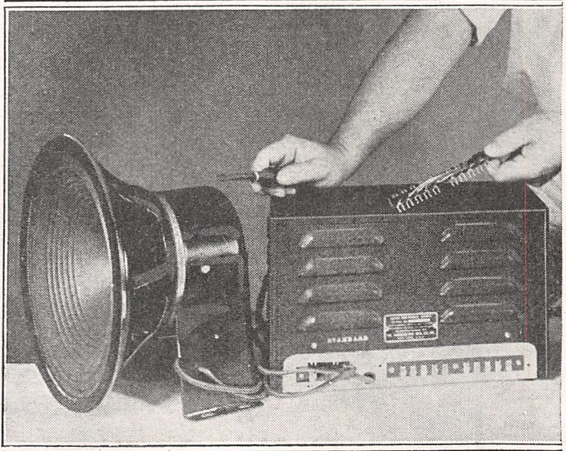


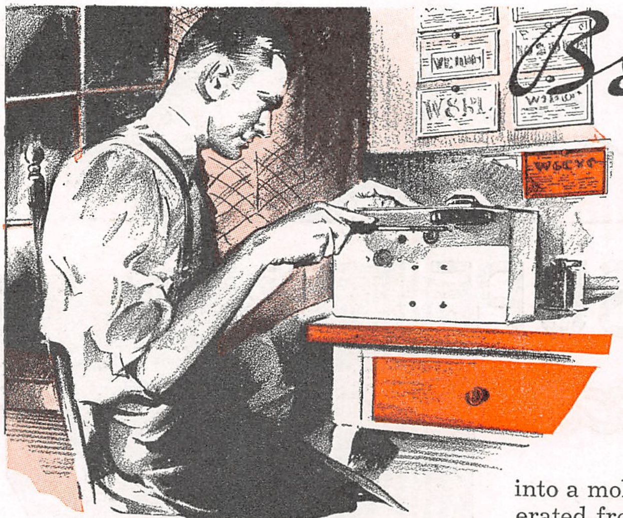
REPLETE with striking features, this 16-tube special amateur-professional receiver is designed to meet every rigid precision specification of the professional operator and advanced amateur.

It consists of two compact major units, the receiver proper supplied in a neat metal table-model cabinet, and the power unit shown in the lower photo. Unusually flexible and complete in every detail, it is engineered to assure maximum sensitivity and extreme selectivity. Although there are no plug-in coils, it is claimed to cover equally well the highest and lowest frequencies from 15 to 560 meters.

The main tuning dial is directly calibrated in megacycles from 2.5 to 20; and in kilocycles from 540 to 2,500. This dial is equipped with an ingenious mechanical shutter which operates in conjunction with the band-changing switch, making visible only the frequency band in actual use. Other features include, two stages of tuned r.f. on each band; 3 air-tuned i.f. stages; 5-band switch; band spread on four of the short-wave bands; beat-frequency oscillator; automatic volume control; tone control and variable selectivity which permits high-fidelity reception at one extreme and needlepoint sharpness at the other. It is also available with crystal filter if desired. A view of the "Super-Pro" chassis assembly is given in the insert photo.







Beginner's

By Perry S. Graffam

HERE is a short-wave 2-tuber, with a coil-changing switch, that any beginner can assemble and wire with ordinary tools. The principal feature is the all-band range without the usual bother of changing plug-in coils. This band-selecting device consists of four universal sockets built into a molded selector switch which is operated from the front panel. Four standard short-wave plug-in coils covering the 20, 40, 80 and 160-meter bands are inserted in the sockets. Any one of these coils can be switched instantly into the circuit by merely turning the knob on the front panel to the proper setting.

The circuit used is very simple, it consists of a regular regenerative detector and an impedance-coupled audio amplifier employing types 38 and 39/44 tubes. These tubes were chosen because they combine dependability with good gain, and, as they were originally designed for automobile use, no difficulties will be encountered from microphonic noises. They are of the 6.3-volt heater type and may be operated from either a small step-down transformer or a 6-volt storage battery. B-batteries are used for the plate supply, and, as the drain is quite low they will last many months. However, if you have a B-eliminator, that may be used instead of the B-batteries. A further suggestion for a power supply, is the "A-B" power unit described in this issue.

Using a 6-volt storage battery for

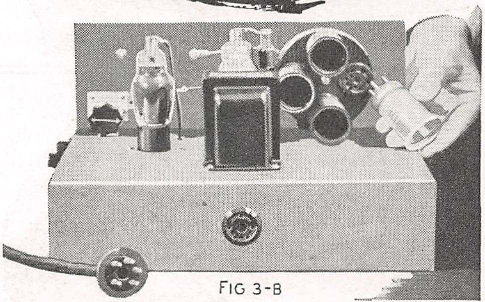
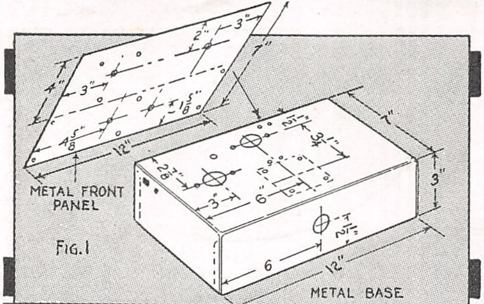
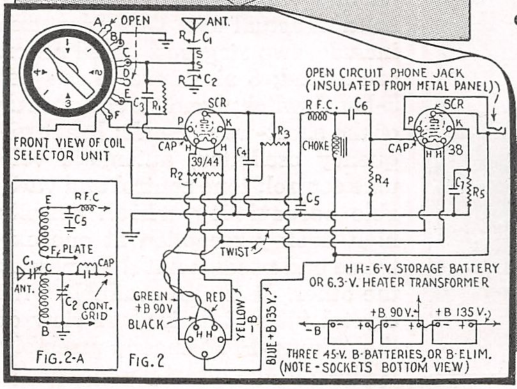


FIG 3-B



3"
2"
1"
4"
3"
4 5/8"
12"
METAL FRONT PANEL
3"
6
3"
12"
METAL BASE

FIG. 1



A
OPEN
B
C
D
E
F
ANT.
R
C1
S
S
R
C2
C3
R1
FRONT VIEW OF COIL SELECTOR UNIT
SCR
P
K
CAP
H
H
39/44
R2
C4
R3
OPEN CIRCUIT PHONE JACK (INSULATED FROM METAL PANEL)
R F.C.
C6
CHOKE
R4
C5
SCR
P
K
CAP
H H
38
C7
R5
TWIST
H H = 6-V. STORAGE BATTERY OR 6.3-V. HEATER TRANSFORMER
GREEN +B 90V
RED
BLACK
H H
YELLOW -B
BLUE +B 135 V.
+B 90 V.
+B 135 V.
-B
THREE 45-V. B-BATTERIES, OR B-ELIM. (NOTE - SOCKETS BOTTOM VIEW)
E
R.F.C
C5
F
PLATE
C1
C
CAP
ANT.
C2
CONT. GRID
B

FIG. 2-A

FIG. 2

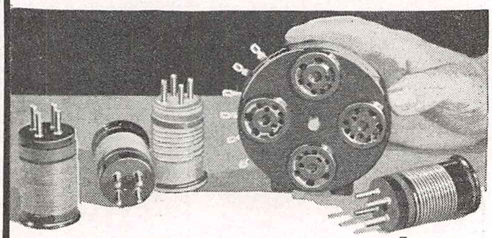


FIG. 3-A

S-W TWO-TUBER *with* Coil Selector

the heaters, the writer obtained some excellent results during the preliminary tests. Foreign signals received with good volume included stations in Spain, Germany, England and South America.

Base and front-panel details appear in Fig. 1; aluminum or any suitable sheet metal may be used. The base and panel are standard sizes, and all parts are obtainable from any of the radio supply houses. It will be noted that the metal chassis is slightly larger than actually required. This is recommended for the convenience of the beginner, and allows plenty of room for variations and improvements that can be added later if desired.

All major parts are fastened to the

(Continued to page 136A)

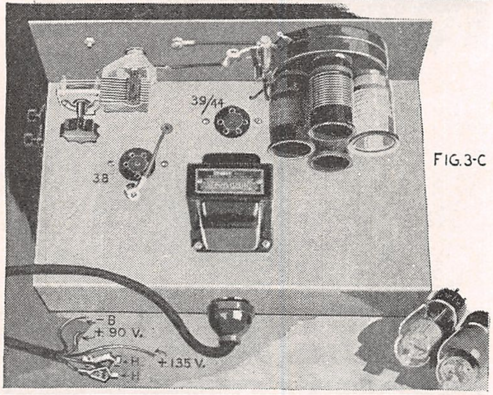

39/44
38
-B
+90 V.
+H
-H
+135 V.

FIG. 3-C

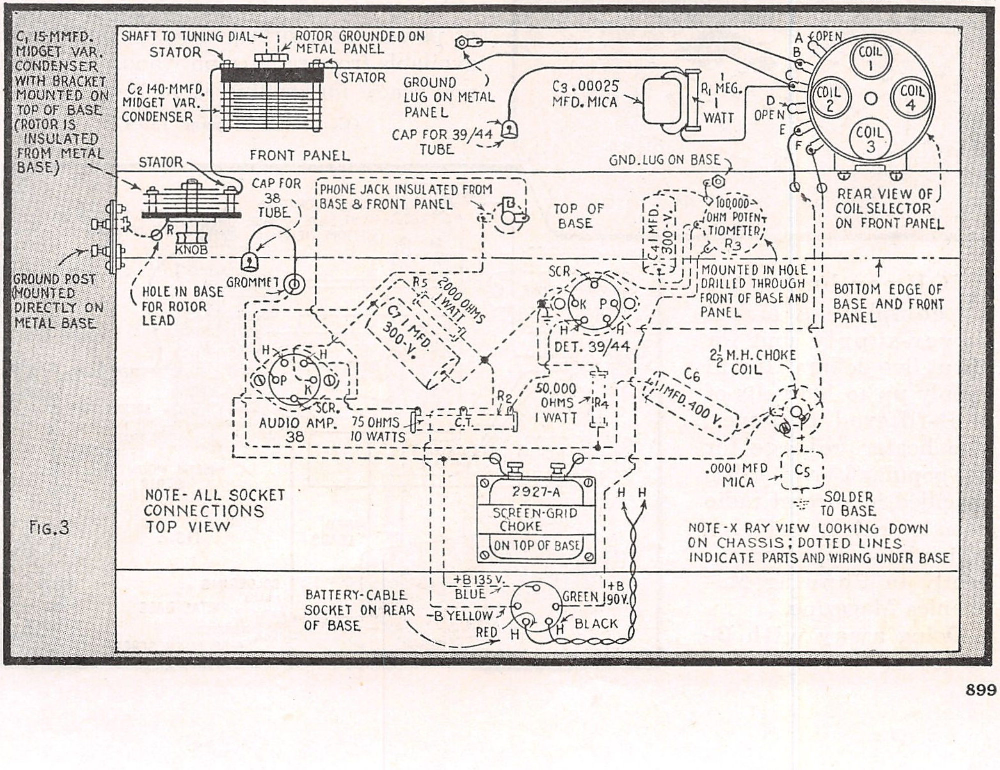
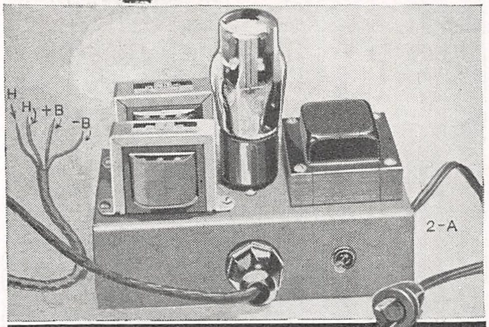

C1 15-MMFD. MIDGET VAR. CONDENSER WITH BRACKET MOUNTED ON TOP OF BASE (ROTOR IS INSULATED FROM METAL BASE)
SHAFT TO TUNING DIAL
STATOR
ROTOR GROUNDED ON METAL PANEL
STATOR
C2 140-MMFD. MIDGET VAR. CONDENSER
GROUND LUG ON METAL PANEL
CAP FOR 39/44 TUBE
C3 .00025 MFD. MICA
R1 1 MEG. 1 WATT
A OPEN
B
C
D OPEN
E
F
COIL 1
COIL 2
COIL 3
COIL 4
FRONT PANEL
GND. LUG ON BASE
STATOR
CAP FOR 38 TUBE
PHONE JACK INSULATED FROM BASE & FRONT PANEL
TOP OF BASE
100,000 OHM POTENTIOMETER R3
C4 1 MFD. 300-V.
REAR VIEW OF COIL SELECTOR ON FRONT PANEL
R
KNOB
GROUND POST (MOUNTED DIRECTLY ON METAL BASE
HOLE IN BASE FOR ROTOR LEAD
GROMMET
R5 2000 OHMS 1 WATT
C7 1 MFD. 300-V.
SCR
K
P
H
DET. 39/44
MOUNTED IN HOLE DRILLED THROUGH FRONT OF BASE AND PANEL
BOTTOM EDGE OF BASE AND FRONT PANEL
H
P
K
SCR.
AUDIO AMP. 38
75 OHMS 10 WATTS
C.T.
R2
50,000 OHMS 1 WATT
R4
2½ M.H. CHOKE COIL
C6
1 MFD. 400 V.
.0001 MFD MICA
C5
SOLDER TO BASE
NOTE - ALL SOCKET CONNECTIONS TOP VIEW
2927-A
SCREEN-GRID CHOKE
ON TOP OF BASE
H H
NOTE - X RAY VIEW LOOKING DOWN ON CHASSIS; DOTTED LINES INDICATE PARTS AND WIRING UNDER BASE
+B 135 V.
BLUE
BATTERY-CABLE SOCKET ON REAR OF BASE
-B YELLOW
RED
H
H
GREEN
+B 90 V.
BLACK

FIG. 3

"A-B" Power Unit for Six-Volt Tube Sets



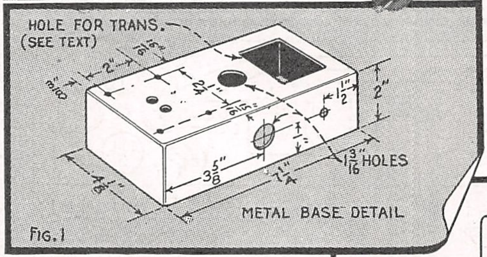

HOLE FOR TRANS.
(SEE TEXT)
2"
5/16"
3/8"
2 1/4"
15/16"
1 1/2"
2"
1"
1 3/16" HOLES
3 5/8"
7 1/4"
4 1/8"
METAL BASE DETAIL

FIG. 1

YOU can build this complete A and B power-supply unit for about five dollars. It will supply up to 180 volts of well-filtered B power, also heater voltage for the popular 6.3-volt tubes specified in several radio construction articles which have appeared recently in Popular Mechanics Magazine.

Doing away with B-batteries, storage battery or a separate heater transformer, it is suitable for use with any receiver using up to five tubes of either the glass or all-metal 6.3-volt variety. Experimenters and service men will find it a handy power unit for trying out new circuits as it can be connected quickly and plugged into any convenient 110-volt, 60-cycle line.

Intermediate B-voltages are easily obtained by connecting a 25,000-ohm, 50-watt, tapped resistor across the output. In this case it will be necessary to by-pass each extra voltage tap with a 1-mfd., 250-volt by-pass condenser to eliminate any hum that might appear at such points. Merely connect one side of the by-pass condenser to the voltage-divider tap and the other side to the common ground soldering lug that is mounted on the metal base. To provide for these extra voltage outlets, a 5 or 6-prong cable socket and plug may be used instead of the 4-prong type shown. There is sufficient room under the metal base to mount the tapped voltage divider and by-pass condensers, thus making a compact and flexible unit.

Construction details for the base appear in Fig. 1; the dimensions of the large cutout will depend, of course, upon the type of power transformer used. This base is available from radio supply houses, formed and ready for drilling if desired. A sim-

(Continued to page 130A)

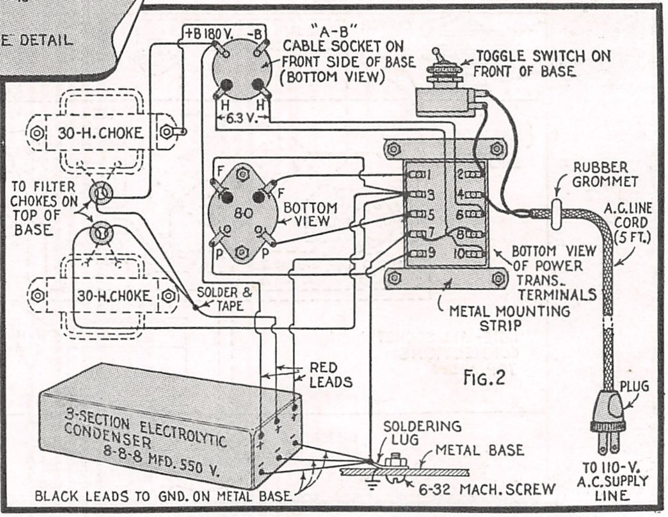
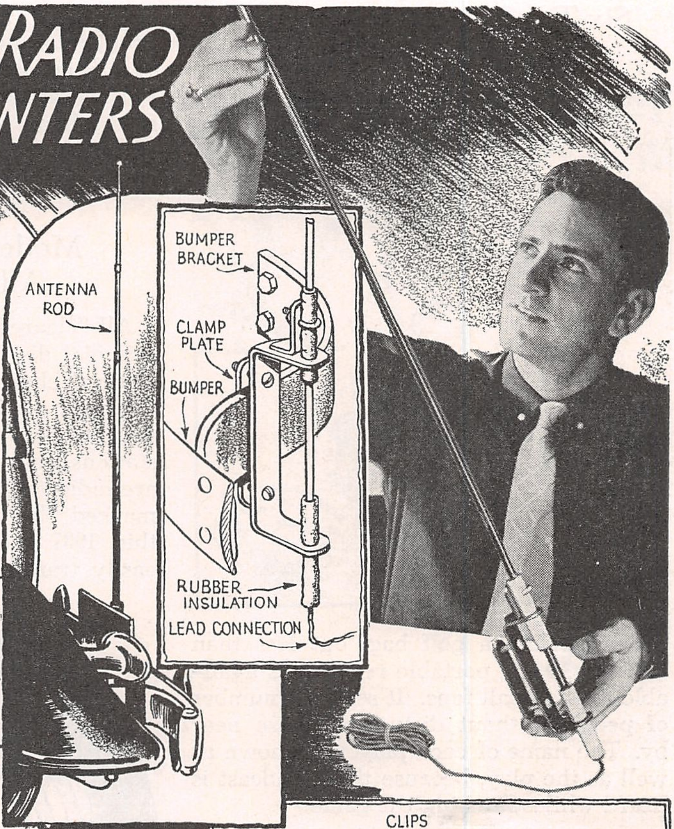
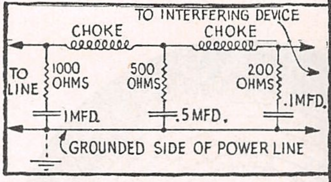

+B 180 V.
-B
"A-B" CABLE SOCKET ON FRONT SIDE OF BASE (BOTTOM VIEW)
H
H
6.3 V.
TOGGLE SWITCH ON FRONT OF BASE
30-H. CHOKE
TO FILTER CHOKES ON TOP OF BASE
F
F
80
BOTTOM VIEW
P
P
1
2
3
4
5
6
7
8
9
10
RUBBER GROMMET
A.C. LINE CORD (5 FT.)
BOTTOM VIEW OF POWER TRANS. TERMINALS
METAL MOUNTING STRIP
30-H. CHOKE
SOLDER & TAPE
RED LEADS
3-SECTION ELECTROLYTIC CONDENSER 8-8-8 MFD. 550 V.
SOLDERING LUG
METAL BASE
6-32 MACH. SCREW
BLACK LEADS TO GND. ON METAL BASE
PLUG
TO 110-V. A.C. SUPPLY LINE

FIG. 2

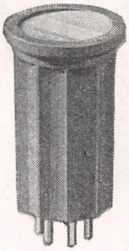
Hints for RADIO EXPERIMENTERS

Tunable car antenna of the telescoping-rod type with special clamp for mounting the insulated rod directly on the bumper bracket. Suitable for use with 5-meter "transceivers" and "transceptors" for 2-way amateur phone, or regular installation on turret-type cars. Below, series-parallel radio noise filter for electric motors; chokes consist of 150 turns of No. 22 d.c.c. magnet wire on 1½-in. forms

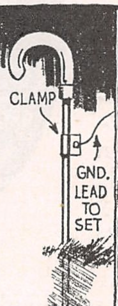

ANTENNA ROD
BUMPER BRACKET
CLAMP PLATE
BUMPER
RUBBER INSULATION
LEAD CONNECTION

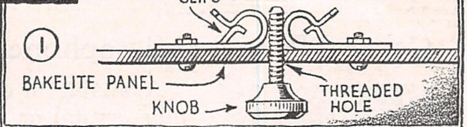

TO INTERFERING DEVICE
CHOKE
CHOKE
TO LINE
1000 OHMS
500 OHMS
200 OHMS
.1MFD.
1MFD.
.5MFD.
GROUNDED SIDE OF POWER LINE

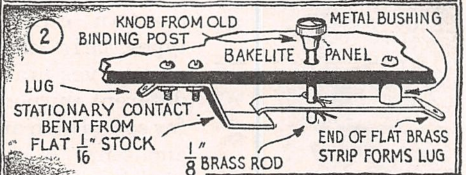
Inexpensive low-loss coil form available with 4, 5 and 6 prongs



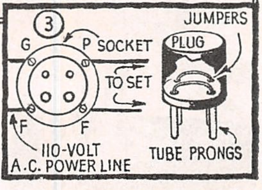
Right, an old umbrella stock makes a handy temporary ground rod for portable receivers and transmitters; sandpaper is used to remove all enamel from metal shaft to provide good contact in damp ground. Below, sturdy antenna mast made from pipe fittings


CLAMP
GND. LEAD TO SET

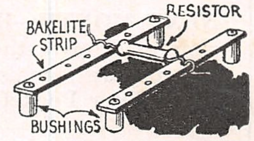

①
CLIPS
BAKELITE PANEL
KNOB
THREADED HOLE

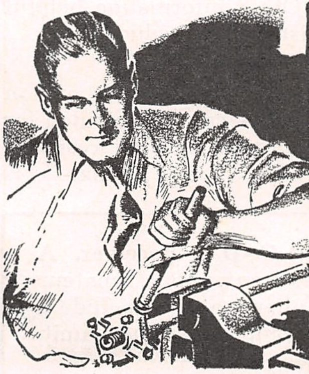

②
KNOB FROM OLD BINDING POST
METAL BUSHING
BAKELITE PANEL
LUG
STATIONARY CONTACT BENT FROM FLAT 1/16" STOCK
1/8" BRASS ROD
END OF FLAT BRASS STRIP FORMS LUG

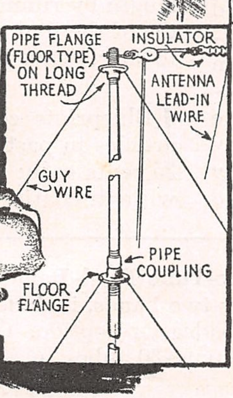
Above, Figs. 1 and 2 show simple experimental switches easily made from odds and ends; Fig. 1 is suitable for battery sets; Fig. 2 is a push-button variety for switching meters in and out of test circuits; a 4-prong socket and an old tube base, shown in Fig. 3, provide an insulated plug-in line switch


③
G
P
SOCKET
PLUG
JUMPERS
TO SET
F
F
110-VOLT A.C. POWER LINE
TUBE PRONGS

Below, insulated mounting for small fixed resistors, made from Bakelite scraps


BAKELITE STRIP
RESISTOR
BUSHINGS

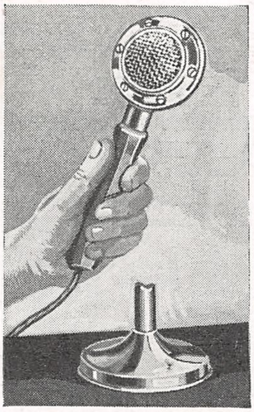



PIPE FLANGE (FLOOR TYPE) ON LONG THREAD
INSULATOR
ANTENNA LEAD-IN WIRE
GUY WIRE
PIPE COUPLING
FLOOR FLANGE

Six-Tube Portable Receiver Goes to the Ball Game

Shaped like a golf bag, but less than half the size, a portable receiver is available for baseball fans. It serves a number of people without disturbing those near by. The name of each player is known as well as the play, because the broadcast is heard while watching the game.

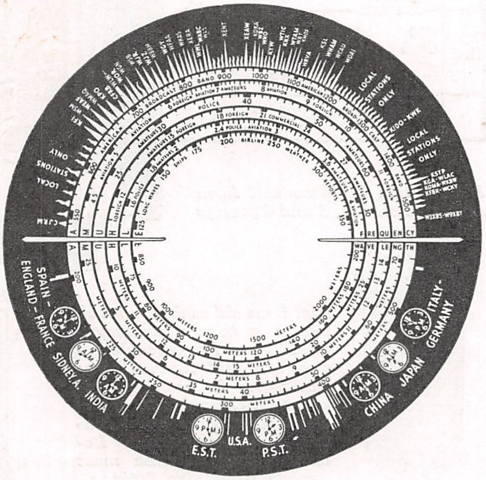
General Purpose Microphone



Available in either crystal or 2-button carbon types, this single unit serves many different purposes for sound men and amateurs. A special handle and base permit instant change from desk to hand instrument. The same "mike" may be adapted easily for direct stand mounting or ring suspension. It solves the problem of the sound man who must make one microphone do the work of many. For the amateur it provides a desk mike at the home station and a hand-type instrument for portable field work without costly duplication.

Modern Dial Simplifies All-Wave Tuning

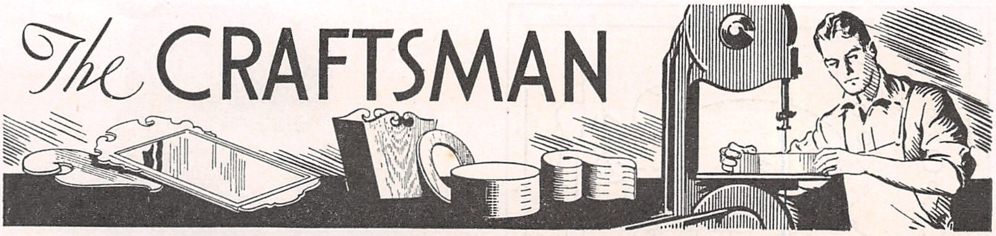
All "cleared channels" are indicated on this dial disk by red triangles; "partially cleared channels" are shown by green triangles with the predominating station call given. Frequencies shared by many stations, and which are useful only locally, are indicated by white wavy lines and are marked "local stations only." Owners of this 1937 model all-wave receiver can easily translate from frequency to wave length by running a line through the center of the dial. Other information helpful to short-wave listeners is included.



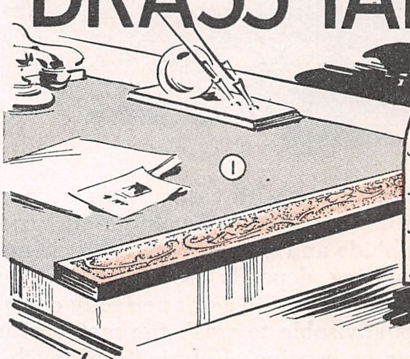
◖Blueprints covering radio construction articles in past issues can be obtained for 25 cents each; material lists are available without charge on receipt of postage.

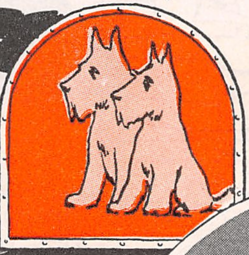
NEXT MONTH—How to Build a Six-Tube Dual-Band A.C.-D.C. Receiver. A simplified up-to-the-minute set; tunes two bands, includes many police, amateur and aircraft signals, also standard broadcast reception. Other features include a **Five-Meter Pocket Receiver** using 2 type-30 tubes in a compact low-cost unit.

The CRAFTSMAN

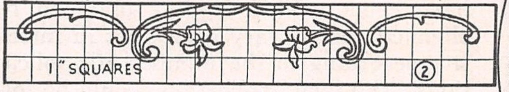


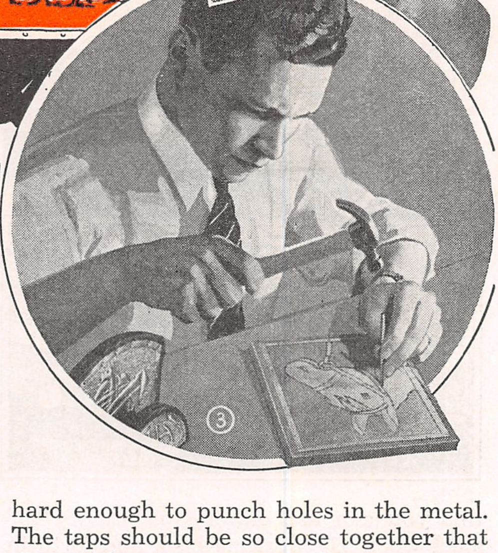
Simplified BRASS TAPPING



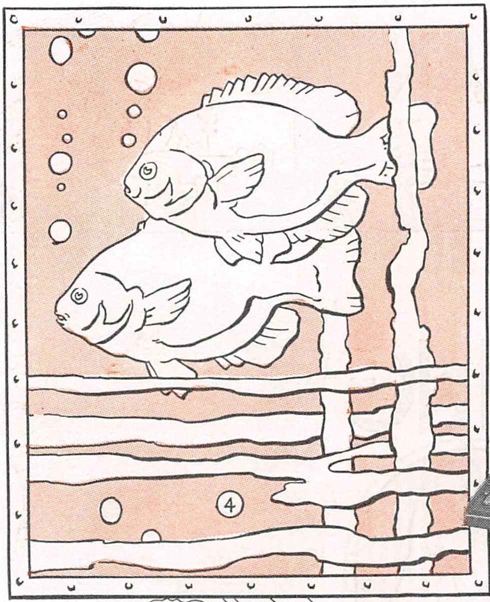


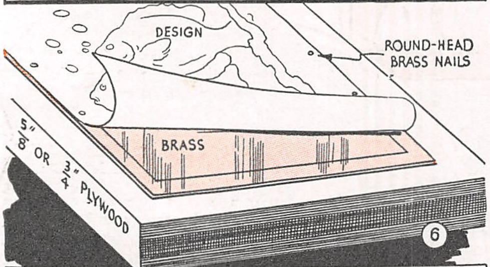
by FLOYD M. MIX

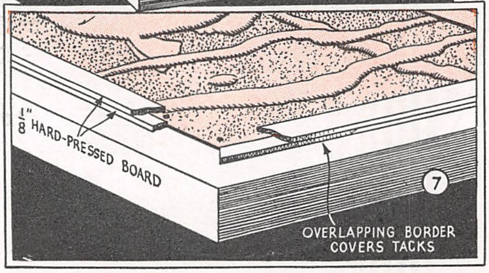




A REAL interesting pastime in which all members of the family can indulge is brass tapping. Attractive patterns that stand out in bold relief on plaques, book ends, etc., are formed by simply punching a design through a paper pattern onto a piece of metal and tapping down the background. To start out, get a piece of 30-ga. soft sheet brass, some plywood for mounting it, a light hammer, small round-head brass nails, and a piece of 1/8-in. steel rod about 5 in. long, which is ground to a 1/32-in. point to form a tapping tool. Steel wool, lacquer, etc., are used for finishing. Fig. 6 shows how a design and a piece of sheet brass are fastened to the plywood. Nail holes are made by piercing the design sheet and metal with the tapping tool. Next, the outlines of the design, including the border, are gone over with the tapping tool as illustrated in Fig. 3, striking it firmly but not hard enough to punch holes in the metal. The taps should be so close together that the resulting impressions form a continuous line. When the transferring of the design has been completed, the paper is torn off and the background tapped down. It is best to make the taps about 1/4 in. apart at first, then go over each section, always avoiding a regularity of pattern, until the surface consists of a solid mass of tool marks. After getting the "knack" of doing this work, the job can be speeded up by using two tapping tools at one time. Polishing of the brass comes next. For





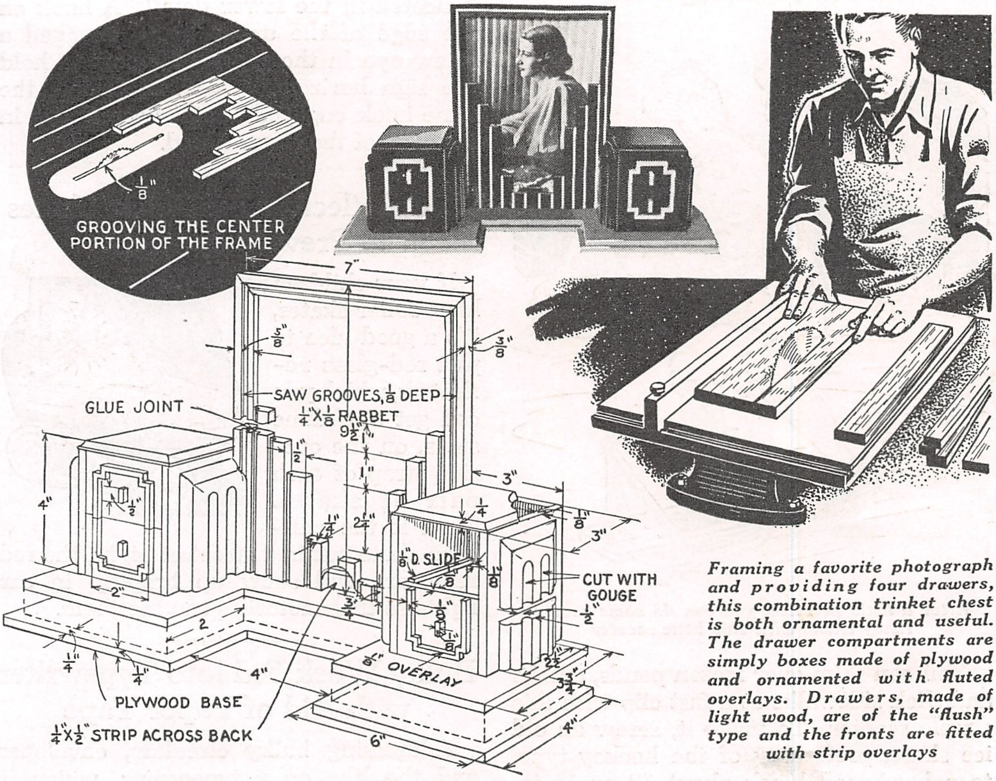


this you can use either No. "0" or "00" steel wool. By working back and forth in the same direction you will be able to produce a bright surface free from scratches. To preserve the shiny surface apply a coat of clear lacquer, Fig. 5, or if desired, color the background by applying bronze of the desired shade. By wiping off the high spots before the bronze has had a chance to set, it is possible to obtain some attractive effects. Still another finish consists of coloring the metal chemically. To get a black finish, dissolve a small quantity of liver of sulphur in water, and apply it to

the background with a small brush. For a red-brown color use a solution of barium sulphide and water. Successful chemical coloring depends to a considerable extent on having the work perfectly clean, so it is advisable to wash the metal with gasoline or benzine. Refrain from touching the cleaned surface until the chemicals have been applied. Colors obtained by chemical action vary somewhat in intensity according to the number of applications. The final application should be followed by a coating of clear lacquer to make the finish permanent.

A simple frame which covers up the nail heads, as shown in Fig. 7, increases the attractiveness of most pieces, especially large ones like the desk-blotter pad, Figs. 1 and 2. The frame consists of two layers of hard-pressed board or veneer glued onto the plywood backing. One piece butts against the edge of the brass, and the other overlaps to cover the nail heads. By anchoring the bottom layer to the plywood with wire brads, the entire glue job can be completed with one clamping. Next comes the finishing of the wood. Sand the surface carefully to remove blemishes, surplus glue, etc., being sure not to mar the finish on the metal. Then, apply a coat of oil stain, wiping off the surplus so that the wood will not be streaked. Finish with a couple coats of wax. If a natural-wood finish is desired use shellac and wax.

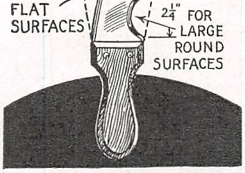
Trinket Chest Holds Photo on Your Vanity


1/8"
GROOVING THE CENTER PORTION OF THE FRAME
7"
5/8"
3/8"
GLUE JOINT
SAW GROOVES, 1/8 DEEP
1/4"X1/8 RABBET
9 1/2"
1"
1/2"
1"
4"
1/2"
2 1/4"
1/4"
3"
1/4"
1/8"
3"
1/8" D. SLIDE
1/8"
1/8"
CUT WITH GOUGE
3/4"
1/8"
1/8"
1/2"
2"
2
1/4"
1/4"
4"
1/8" OVERLAY
2 1/2"
3 3/4"
PLYWOOD BASE
1/4"X1/2" STRIP ACROSS BACK
6"
4"

Framing a favorite photograph and providing four drawers, this combination trinket chest is both ornamental and useful. The drawer compartments are simply boxes made of plywood and ornamented with fluted overlays. Drawers, made of light wood, are of the "flush" type and the fronts are fitted with strip overlays

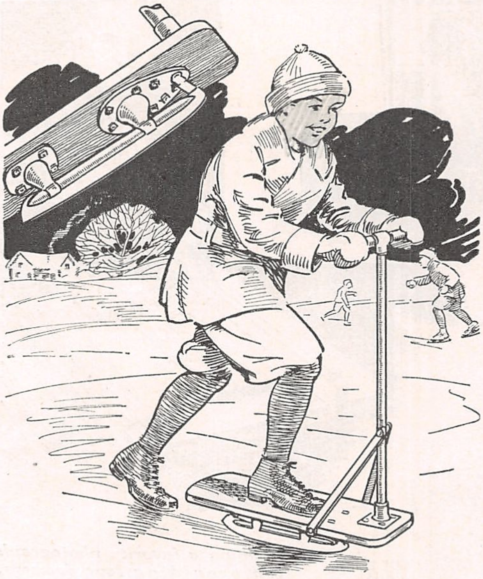
Two tiny drawer compartments and a photo frame mounted on a two-part offset base make up this attractive trinket chest. This project will work up well in fancy contrasting woods or, if you prefer, you can use plywood throughout, excepting, of course, the photo frame, which should be of solid stock. Using either material, the procedure is much the same. First, you get out the base to the size given and glue the two parts together. Then come the two drawer compartments which are duplicates, with fluted overlays on each side. The flutes can be cut with a ¼-in. gouge. The drawer fronts are made up as a single piece with the overlay glued in place. Then they are sawed in half, allowance being made for the width of the saw cut to assure perfect fit. The ends are then rabbeted for the sides and the inside face is grooved for the bottom, 1/16-in. plywood being used for the latter. The photo frame is made up and joined just like a picture frame and an overlay is cut and fitted inside as shown. Then the three parts are mounted on the base ready for finishing. If you use plywood the whole thing can be enameled black and then striped with white.

Scraper to Remove Varnish


BEVELED EDGES
FOR SMALL ROUND SURFACES
1 5/8"
FOR FLAT SURFACES
2 1/4"
FOR LARGE ROUND SURFACES

Made from a wood scraper or an old butcher knife having a high-grade steel blade, this scraper was designed to remove dry varnish, liquid removers being undesirable as they tend to discolor the wood or may even soak through a thin-veneered surface and soften the glue. All cutting edges are beveled or sharpened to a knife edge, after which they are slightly squared on an oilstone.

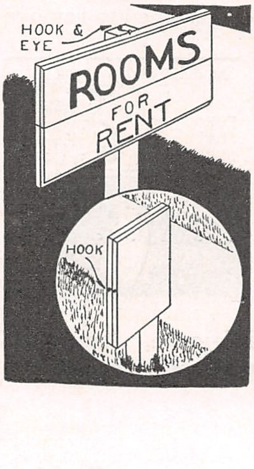
Ice Scooter from Old Skate Gives Thrilling Ride



After a little practice, you can do some pretty fancy tricks with this little scooter

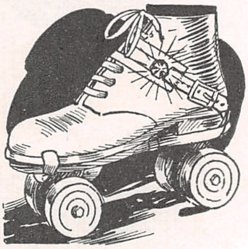
You can skim over frozen ponds, creeks and slick sidewalks at a fast clip with this simple scooter. To make it, screw an old ice skate, preferably of the hockey type, to a hardwood block about 12 or 15 in. long and 6 in. wide. A length of ¾-in. pipe attached to one end of the block with a floor flange carries the handle, which is a tee fitted with two nipples threaded at one end only. A couple of flat-iron braces will help stiffen the pipe assembly.

"For Rent" Sign Folds Up When Not Needed



One home owner who rented rooms to tourists fixed his roadside sign so that it could be folded up when all the rooms were rented. The sign was made by hinging two boards together and pivoting them to a post slightly off center with a lag screw so that when the sign was folded it would hang in a vertical position, as indicated in the lower detail. A hook on the edge of the upper board engaged a screw eye in the top of the post to hold the sign horizontally. When folded, the same hook engaged another screw eye in the edge of the lower board.

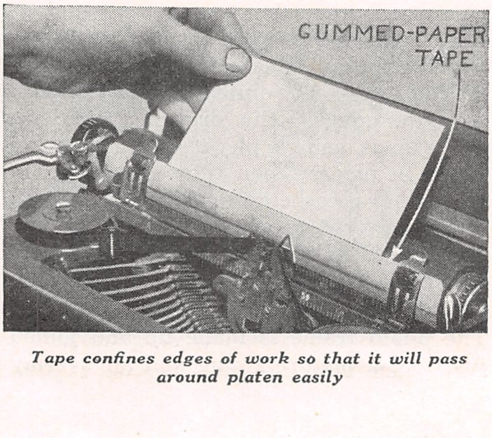
Red Reflectors on Roller Skates to Prevent Accidents



If your children have roller skates, it's a good idea to put red-glass reflectors, which you can get at a dime store, on the outside strap of each pair of skates. Then if the children skate out in a street at night, the red reflectors will show up brightly in car lights so that motorists can see them.

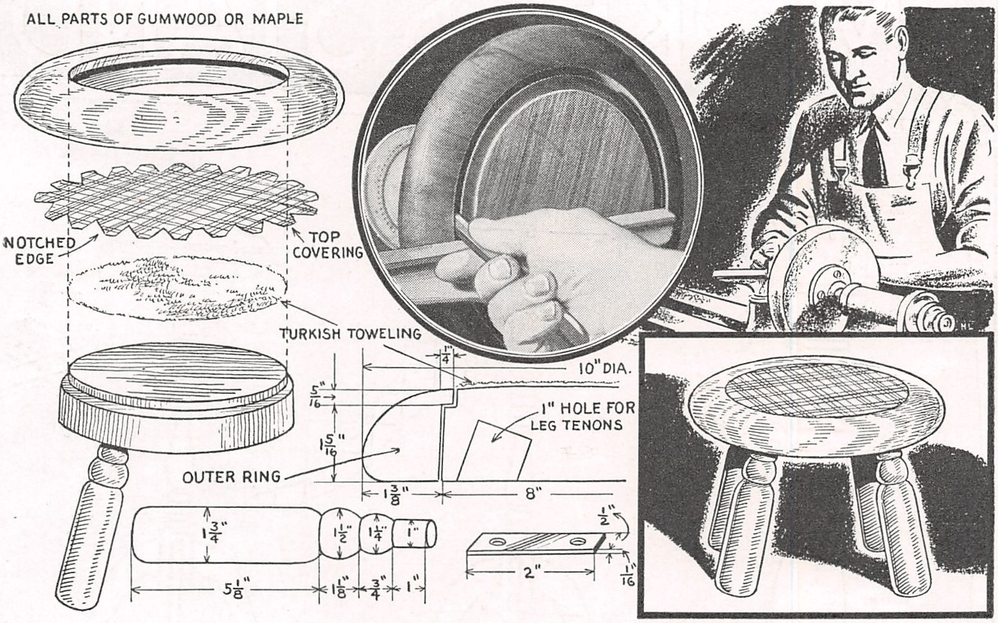
Bulky Work Fed into Typewriter with Aid of Paper Tape

Addressing bulky circulars, envelopes and the like on a typewriter, which is usually a difficult job, can be done easily with the aid of a 1-in. strip of gummed-paper tape stuck to the platen as indicated. One side of the strip is left free, forming a slot into which the work is inserted, and placed in position to be typed by rolling it down from the front instead of through the machine. When the work is finished, the tape may be removed without injury to the platen.



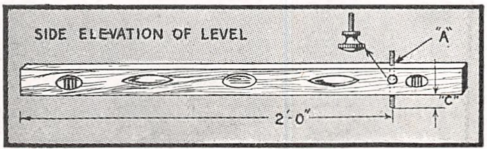
Tape confines edges of work so that it will pass around platen easily

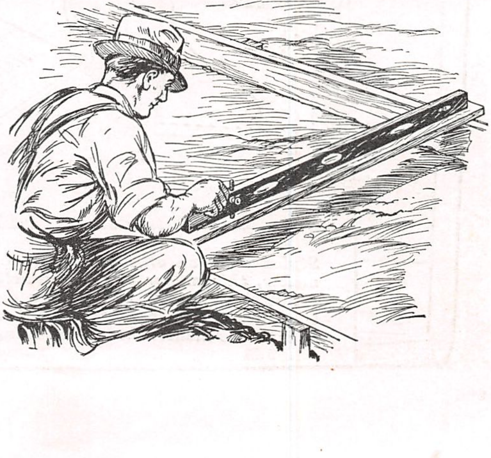
Upholstered Stool Comes Apart for Cleaning


ALL PARTS OF GUMWOOD OR MAPLE
NOTCHED EDGE
TOP COVERING
TURKISH TOWELING
1/4"
10" DIA.
5/16"
1" HOLE FOR LEG TENONS
1 5/16"
OUTER RING
1 3/8"
8"
1 3/4"
1 1/2"
1 1/4"
1"
5 1/8"
1 1/8"
3/4"
1"
1/2"
2"
1/16"

As the cloth of this footstool is held in place by a removable ring, it can be taken off and cleaned easily. The ring comes down over the sides of the base and binds the cloth in place. Before assembling the stool, glue a piece of heavy Turkish toweling to the top surface of the base to cushion the upholstering cloth, which is serrated around the edge so that it can be clamped under the ring without wrinkling. Two short pieces of flat iron, screwed to the bottom sides of the ring and base, hold the assembly together. Finish the wood in the natural color.

Carpenter's Level with Adjustable Pin Aids in Sloping Work

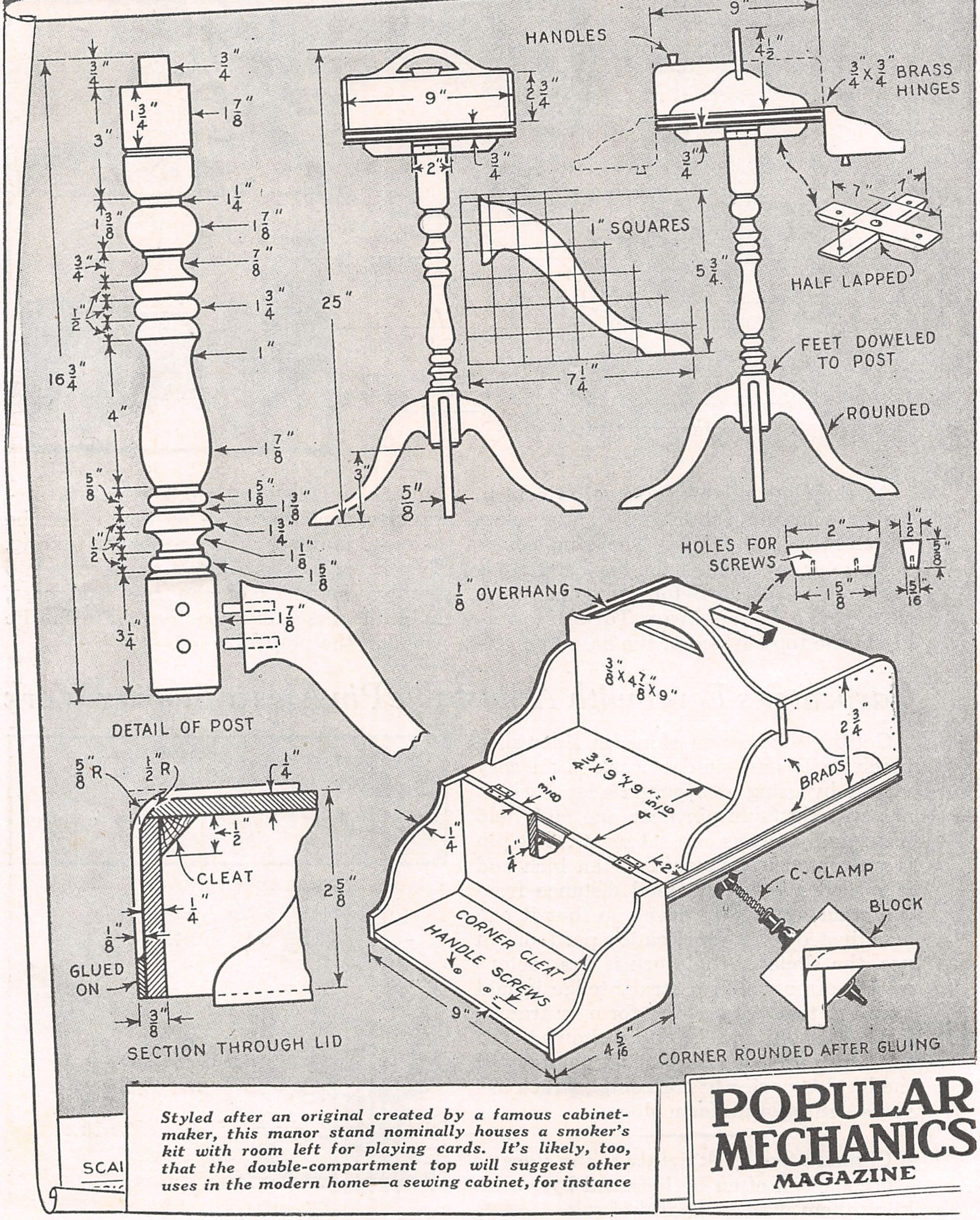

SIDE ELEVATION OF LEVEL
"A"
"C"
2'-0"



Getting the correct slope on sidewalks, porch roofs and similar work is an easy matter by using a carpenter's level which has an adjustable pin near one end, held securely by means of a set screw. The pin is graduated in sixteenths of an inch and is spaced a predetermined distance from the other end of the level, so that it can be adjusted to any inclination per foot. In use, the slope of the work is first determined, after which a straightedge is laid over the two sides of the form or framework to hold the level as shown. The forms are then adjusted at all points until the level is perfectly horizontal, which assures getting a uniform slope.

¶Clinkers that stick tightly to the sides of a firebox can often be loosened by sprinkling them with a handful of salt.

SMOKER'S STAND

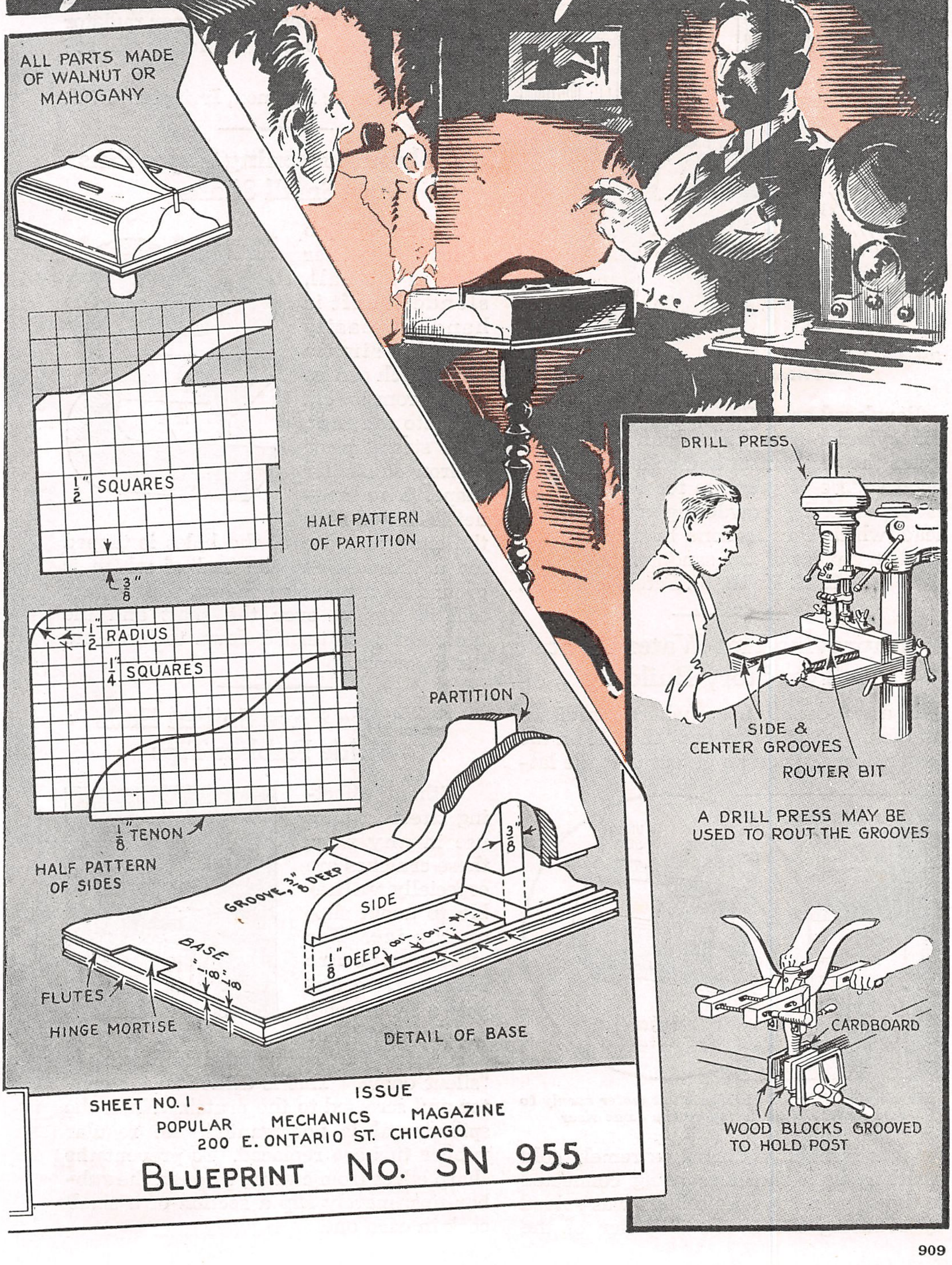


3/4"
3/4"
1 3/4"
1 7/8"
3"
1 1/4"
1 3/8"
1 7/8"
3/4"
7/8"
1 3/4"
1/2"
1"
16 3/4"
4"
1 7/8"
5/8"
1 5/8"
1 3/8"
1 3/4"
1/2"
1 1/8"
1 5/8"
3 1/4"
1 7/8"
DETAIL OF POST
HANDLES
9"
2 3/4"
2"
3/4"
25"
3"
5/8"
1" SQUARES
5 3/4"
7 1/4"
9"
4 1/2"
3/4" X 3/4" BRASS HINGES
3/4"
7"
7"
HALF LAPPED
FEET DOWELED TO POST
ROUNDED
HOLES FOR SCREWS
2"
1 5/8"
1/2"
5/8"
5/16"
1/8" OVERHANG
3/8" X 4 7/8" X 9"
2 3/4"
BRADS
3/4" X 9" X 9"
4 5/16"
3/8"
1/4"
1/4"
2"
C-CLAMP
BLOCK
CORNER CLEAT
HANDLE SCREWS
9"
4 5/16"
CORNER ROUNDED AFTER GLUING
5/8" R
1/2" R
1/4"
1/2"
CLEAT
1/4"
2 5/8"
1/8"
GLUED ON
3/8"
SECTION THROUGH LID
SCAI

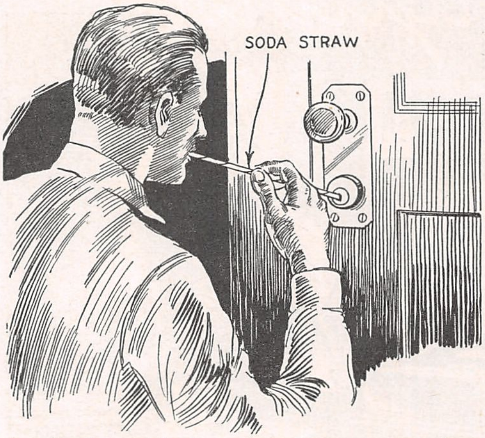
Styled after an original created by a famous cabinet-maker, this manor stand nominally houses a smoker's kit with room left for playing cards. It's likely, too, that the double-compartment top will suggest other uses in the modern home—a sewing cabinet, for instance

POPULAR MECHANICS MAGAZINE

from Old England


ALL PARTS MADE OF WALNUT OR MAHOGANY
1/2" SQUARES
3/8"
HALF PATTERN OF PARTITION
1/2" RADIUS
1/4" SQUARES
1/8" TENON
HALF PATTERN OF SIDES
PARTITION
3/8"
GROOVE, 3/8" DEEP
SIDE
1/8" DEEP
BASE
FLUTES
HINGE MORTISE
DETAIL OF BASE
SHEET NO. 1
ISSUE
POPULAR MECHANICS MAGAZINE
200 E. ONTARIO ST. CHICAGO
BLUEPRINT No. SN 955
DRILL PRESS
SIDE & CENTER GROOVES
ROUTER BIT
A DRILL PRESS MAY BE USED TO ROUT THE GROOVES
CARDBOARD
WOOD BLOCKS GROOVED TO HOLD POST

Lubricant Blown into Door Lock with Soda Straw



Powdered graphite blown into cylinder-type locks is a better lubricant than oil

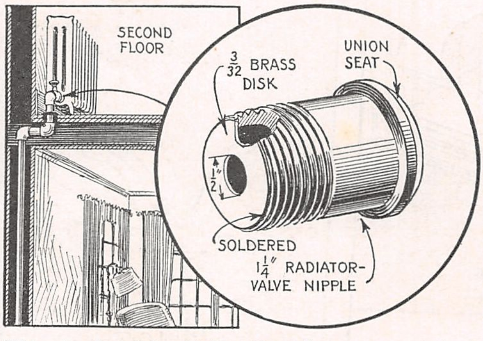
Powdered graphite is a better lubricant for cylinder-type locks than oil, which gums the mechanism and collects dust. A good source of graphite for this purpose is obtained by powdering a soft-pencil lead, which can be done by rubbing the lead on a piece of fine sandpaper.

—K. F. Keith, St. Petersburg, Fla.

Improving Hot-Water Plant in Two-Story Building

In a two-family home where a radiator on the upper floor "robbed" the one on the lower floor to such an extent that the latter was ineffective during extremely cold weather, both radiators being connected to the same riser, the problem was solved by reducing the inside diameter of the pipe nipple at the upper radiator. This was done by soldering a brass disk over the threaded end of the nipple, which was 1¼ in. in diameter, and drilling a ½-in. hole in the center as shown. This reduced the flow of hot water to the upper radiator more than half so that the lower one received plenty.

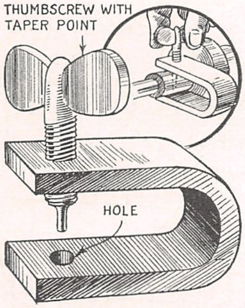
—James R. Knox, Irvington, N. Y.



This simple trick will distribute hot water evenly to two radiators connected to the same riser

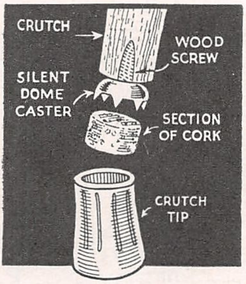
Tool for Loosening Taper Pins in Small Shafts

The tricky job of loosening taper pins in a small, slender shaft is handled easily with this simple tool, which can be made from an old magneto magnet, or a strong piece of iron of similar shape. The magnet is drilled near the ends, and one of the holes is tapped for a thumbscrew, the end of which is ground to a point as shown. In use, the tool is slipped over the shaft and the thumbscrew is turned down to force out the taper pin.



Crutches Have Spiked Ends Inside Rubber Tips

Without affecting their regular use in any way, these crutches are especially valuable to avoid slips on the ice. The rubber tips are removed to expose a spiked end, which consists of a serrated furniture glider known as a "silent dome." This is drilled in the center and screwed to the crutch. When the spiked end is not wanted, the regular rubber tips are replaced. To prevent the sharp edges from cutting through the rubber tips, merely slip a section of a small cork in each one.

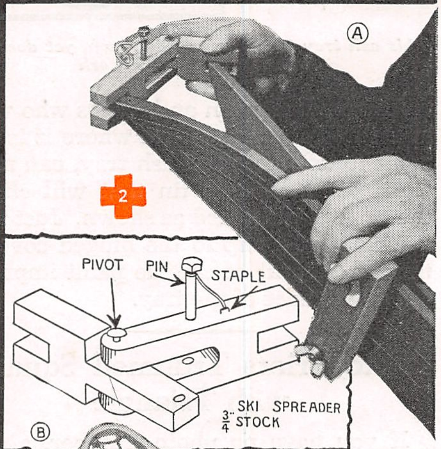


FIRST AID
FOR WINTER-SPORT EQUIPMENT

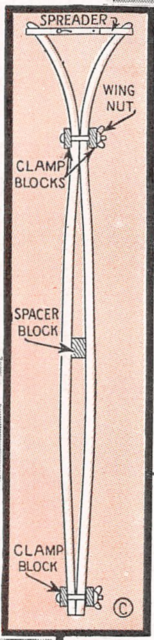
SKIS, toboggans, or any other winter-sport equipment with wood runners, should be waxed on the running surfaces before using. This prevents wet snow sticking to the wood. A good wax can be made by using the formula shown in Fig. 1. Application is made by heating the wax slightly so that it can be swabbed on with a soft cloth. Fig. 2, A, shows equipment for preserving the toe bend and arch of skis. The toe spreader, B, is a simple gadget made up from ¾-in. hardwood. Both the toe spreader and the arch-spreader block should be of a size to slightly force the wood, as at C. Every skater appreciates the advantages of hollow-ground blades, and Fig. 3 pictures a way to "hollow-grind" ice skates on the drill press fitted with a sanding drum. The wood guide keeps the skate blade square to the drum surface, while the diameter of the drum gives just the right amount of "hollow." If you snowshoe with hard-heeled boots, fasten a square of leather to the lacing as in Fig. 4. This little stunt will save a lot of patching.

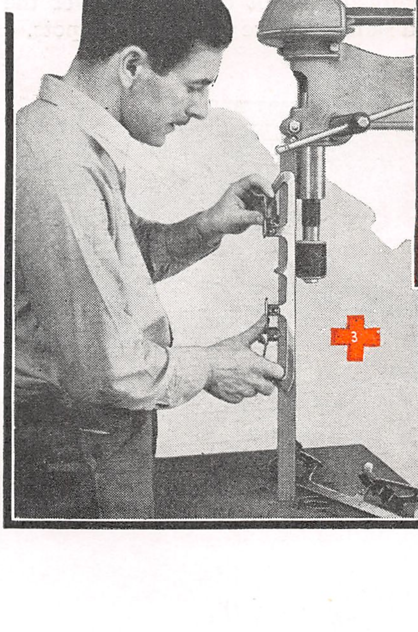
1

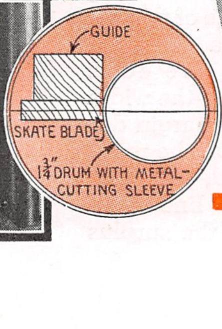
— SKI WAX —
10 OZ., BEESWAX
5 OZ., ROSIN
MELT TOGETHER
THEN ADD 1 OZ.
TURPENTINE. POUR
IN SMALL BOXES TO
FORM CAKES

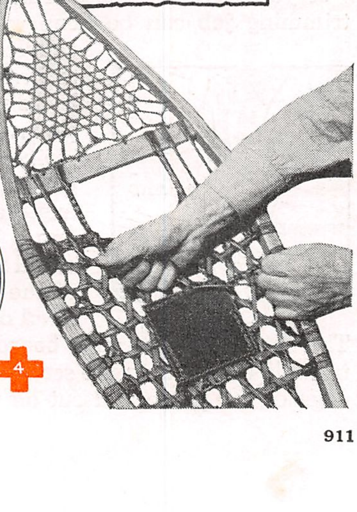

2

Ⓐ
PIVOT
PIN
STAPLE
¾" SKI SPREADER STOCK
Ⓑ

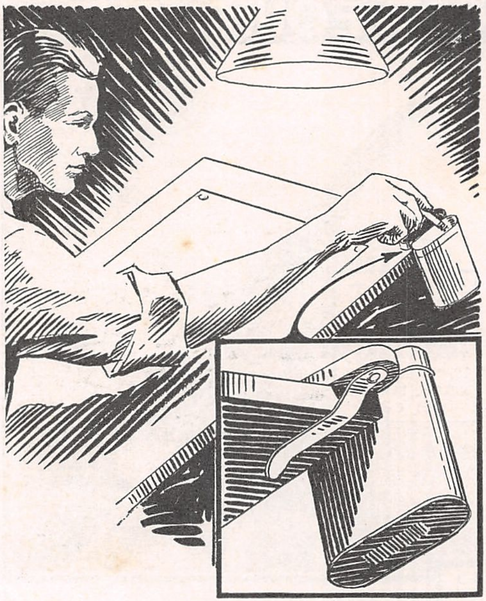

SPREADER
WING NUT
CLAMP BLOCKS
SPACER BLOCK
CLAMP BLOCK
Ⓒ


3


GUIDE
SKATE BLADE
1¾" DRUM WITH METAL-CUTTING SLEEVE


4

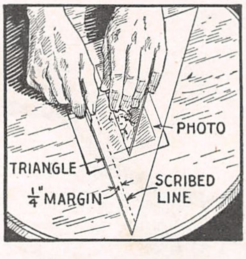
Artist's Improvised Ash Tray Clips over Drawing Board



This ash tray is always within reach, yet does not interfere with your work

Artists, draftsmen and others who work at a tilted drawing board where it is difficult to use a regular ash tray, can make one from a tobacco tin that will clip to the edge of the board as shown. Just rivet a spring-steel clip to the hinged cover of the tin. A coat of crackle paint improves the appearance of the tray.

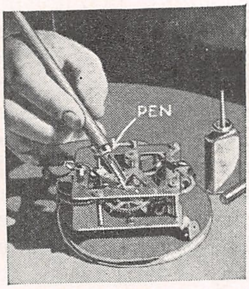
Photo Prints Trimmed Squarely with Triangle



If you have no photo trimmer, a good trimming job can be done with a cheap celluloid triangle and a safety-razor blade. With a pointed tool, scribe a line along one side of the triangle a distance from the edge equal to the width of the margin desired on the print. Then lay the print on a board, place the triangle on top with the scribed line at the edge of the photo and cut off the surplus paper with the razor blade. It is best to make a few practice strokes on some scrap material, substituting a piece of wood for the triangle, until you get the knack of holding the blade to keep it from digging into the straightedge. Also cut across the grain of the board to eliminate the tendency of the razor blade to follow the grain and make the job difficult.

—Arthur Trauffer, Chicago.

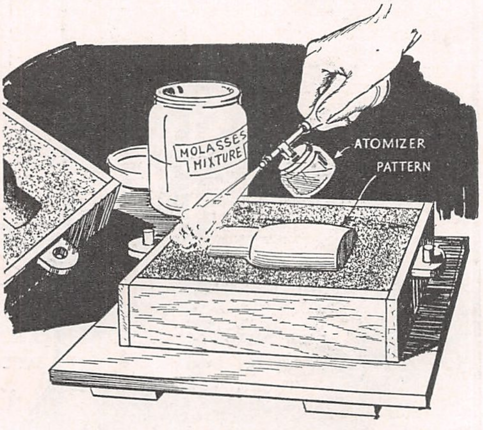
Pen Aids in Oiling Clocks



Instead of oiling the works of a clock with a small can, which generally results in using too much, use an ordinary writing pen. Just dip the point in the oil or apply a few drops from the can, and then touch the point of the pen to the part to be lubricated.

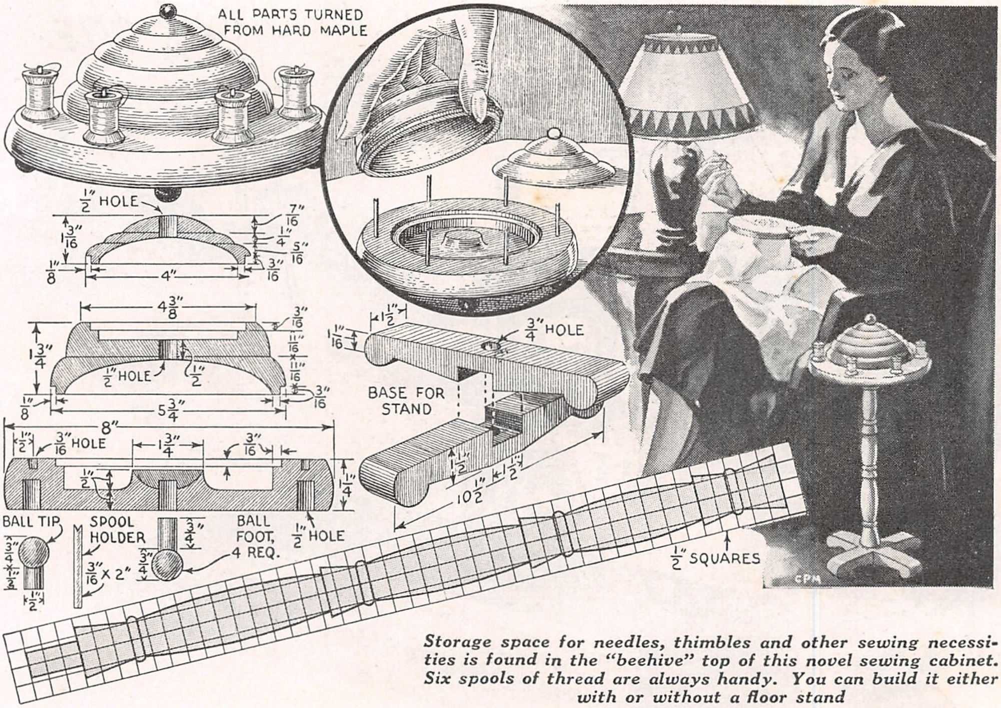
Simple Idea Helps Home Molder

Both the home and professional molder will find that they can get better castings if an atomizer is substituted for the usual swab to dampen the sand around the pattern when removing it. The atomizer applies the molasses-and-water mixture uniformly, does not displace any of the packed sand or make it too wet in spots.



Dampening the sand around a pattern with an atomizer assures a better casting

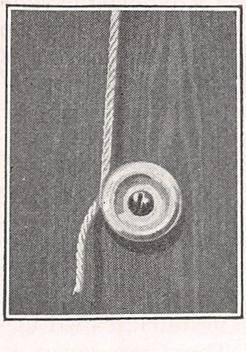
"Beehive" Sewing Cabinet Turned on Lathe


ALL PARTS TURNED FROM HARD MAPLE
1/2" HOLE
7/16"
1 3/16"
1/4"
5/16"
1/8"
4"
3/16"
4 3/8"
3/16"
1 3/4"
11/16"
11/16"
1/2" HOLE
1/2"
1/8"
5 3/4"
3/16"
8"
1/2"
3/16" HOLE
1 3/4"
3/16"
1/2"
1 1/4"
BALL TIP
SPOOL HOLDER
3/16" X 2"
3/4"
3/4"
BALL FOOT, 4 REQ.
1/2" HOLE
3/4"
1/2"
1/2"
1 1/2"
1 1/16"
3/4" HOLE
BASE FOR STAND
1 1/2"
1 1/2"
10 1/2"
1/2" SQUARES
CPM

Storage space for needles, thimbles and other sewing necessities is found in the "beehive" top of this novel sewing cabinet. Six spools of thread are always handy. You can build it either with or without a floor stand

This sewing cabinet is an "all-lathe" project, for the cabinet and the column which supports it are assembled from turnings; the only exception is the two-part base for the stand. As you will see from the details, the cabinet is a two-compartment affair made up of three separate turnings, the lower piece turned and recessed from a single thickness of stock and fitted with pins or holders for a half-dozen spools of thread. The second member will require two thicknesses of stock, glued together, and the top member three thicknesses. You can finish these parts right on the lathe. First, sand and apply an oil stain—light oak color is just right—and wipe off the excess. Allow to dry thoroughly and then, with the work mounted and the lathe running, apply wax and polish with a cloth. The cabinet can be made either with or without the stand. If you want the latter, lay out and turn the column and attach the base of the cabinet to one end with a single screw. Or, you can form a dowel on the upper end and glue this in a hole bored in the base as shown. Saw out the base members and cut the half-lap point as indicated. Finish these parts to match the cabinet. If the cabinet is mounted on a stand the ball feet can be omitted.

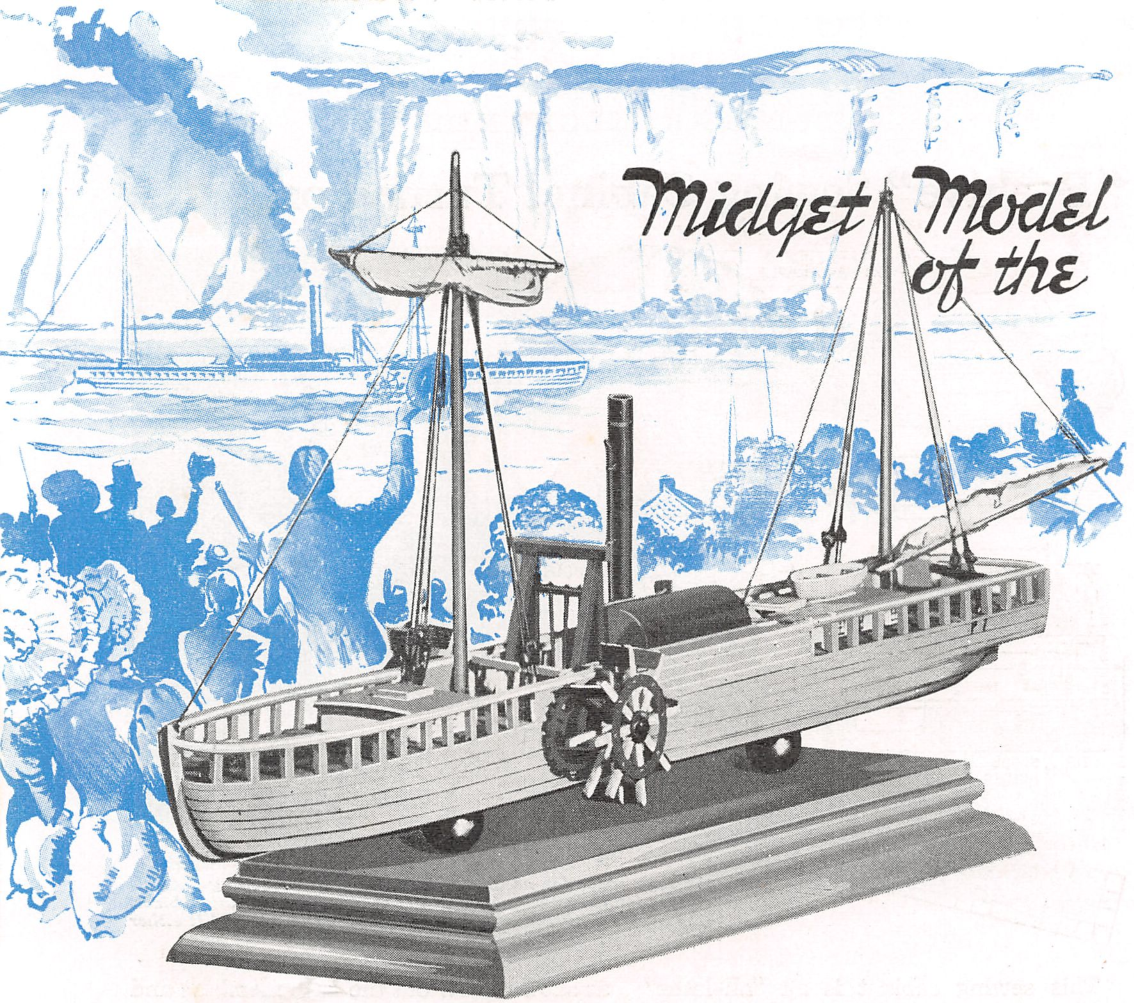
Cord Tie for Adjustable Shades



I find that good ties for the ends of ropes on awnings, roller shades, etc., can be had by using rubber-tired wheels from toys. When the wheels are fastened to a wall with round-head screws, you have a neat job, and the cords are easily fastened by winding them once around the lower part of the curved rubber rings and drawing some of the loose cord behind them as shown.

—Frank Bentley, Jr., Missouri Valley, Ia.

Midget Model of the

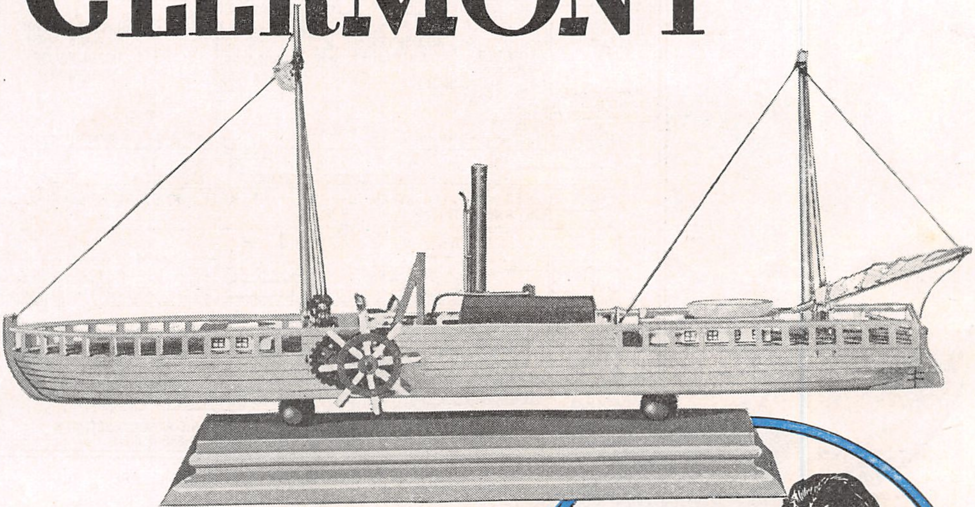


EARLY in the nineteenth century, when rumor brought word to the good folk living along the Hudson that, "a fellow named Fulton had built a boat and in it, planned to make the trip from New York City to Albany under steam power alone," popular opinion promptly dubbed the venture impossible. Robert Fulton became the target for criticism and derision, harsh and unfeeling. Yet his famous "Clermont" not only made the run, it effectively silenced the critics and jesters and inaugurated an era of steamship development.

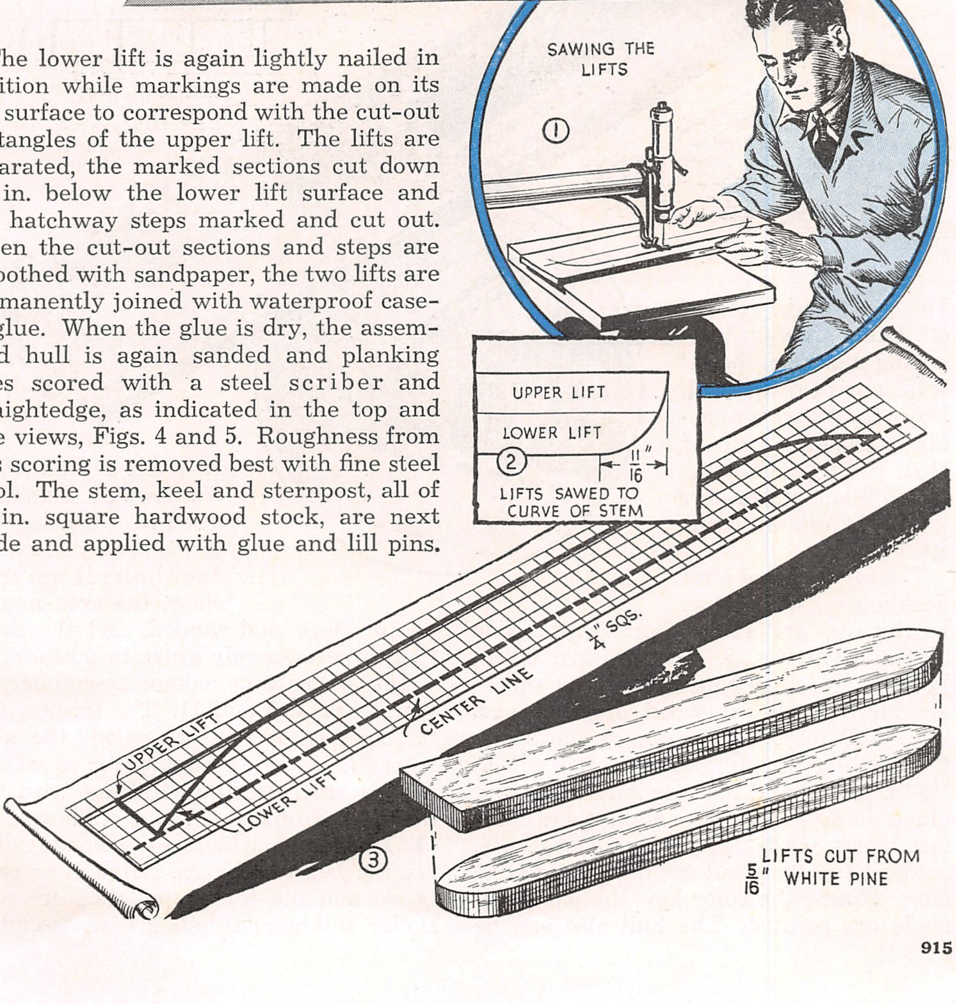
Although small and extremely easy to construct, this model is designed to scale and retains all the important details of the original "Clermont." The hull is made from two white pine boards, $12\frac{3}{8}$ in. long, $1\frac{11}{16}$ in. wide and $\frac{5}{16}$ in. thick, called upper and lower lifts. These are sawed to their respective shapes, as in Fig. 1, using the lift lines, Fig. 3, for patterns. They are then temporarily nailed together and beveled to conform with the amidships section, Fig. 4. While together, the bow end is sawed to the curve of the stem as in the side view, Fig. 2, and carved with a jackknife or small drawshave to a smooth bow section. Pencil centerlines are now drawn on the top and bottom. Then the boards are taken apart and the stern end of the lower lift is carved to approximate hull section "A," reducing to meet the sternpost and widening forward to merge with the beveled section previously cut. The 30-degree bevel of the lower lift at the stern should be noted and cut, then carved as described just above.

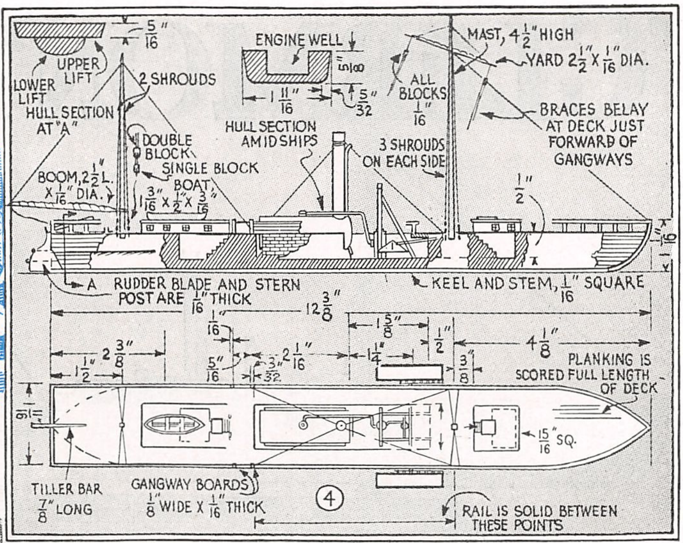
Now, on the top surface of the upper lift, rectangles are laid out corresponding with the forward and after hatches and engine well, to the sizes shown in the top and side views, Fig. 4. At indicated points on the centerline, $\frac{3}{32}$-in. holes are drilled to receive the masts. The rectangular openings are cut entirely through the upper lift, care being taken to provide for the steps of both hatches.

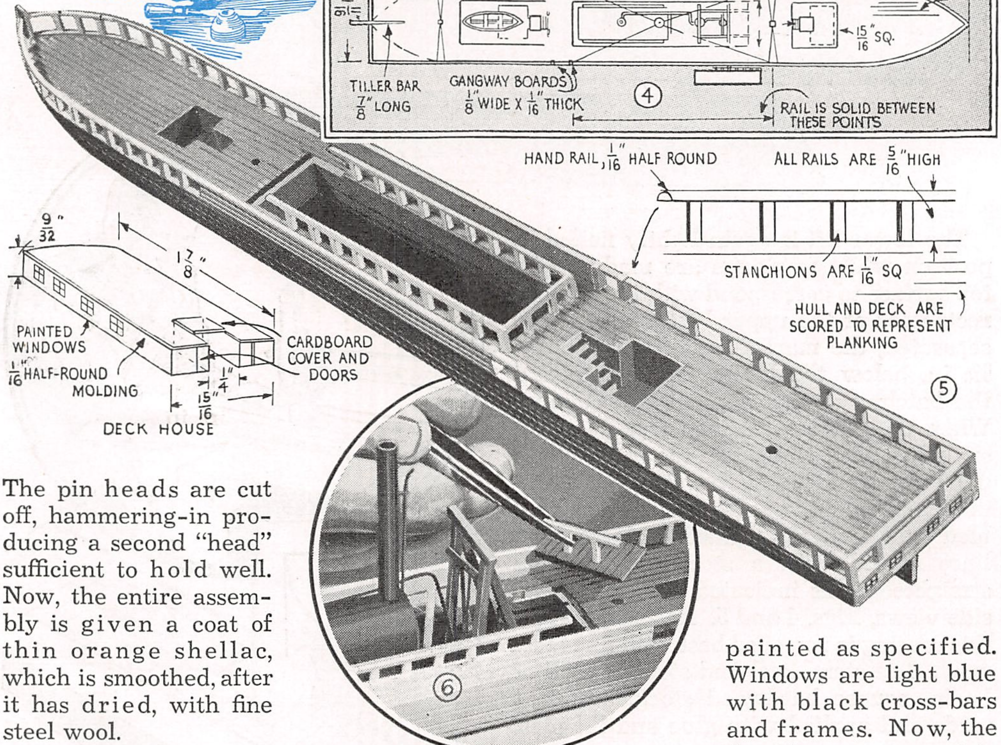
"CLERMONT"



The lower lift is again lightly nailed in position while markings are made on its top surface to correspond with the cut-out rectangles of the upper lift. The lifts are separated, the marked sections cut down 3/16 in. below the lower lift surface and the hatchway steps marked and cut out. When the cut-out sections and steps are smoothed with sandpaper, the two lifts are permanently joined with waterproof casein glue. When the glue is dry, the assembled hull is again sanded and planking lines scored with a steel scriber and straightedge, as indicated in the top and side views, Figs. 4 and 5. Roughness from this scoring is removed best with fine steel wool. The stem, keel and sternpost, all of 1/16-in. square hardwood stock, are next made and applied with glue and lill pins.


SAWING THE LIFTS
①
UPPER LIFT
LOWER LIFT
②
11/16"
LIFTS SAWED TO CURVE OF STEM
UPPER LIFT
CENTER LINE
1/4" SQS.
LOWER LIFT
③
LIFTS CUT FROM 5/16" WHITE PINE

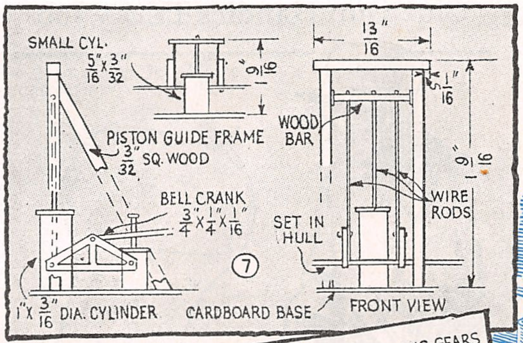

5/16"
UPPER LIFT
LOWER LIFT
HULL SECTION AT "A"
2 SHROUDS
DOUBLE BLOCK
SINGLE BLOCK
BOOM, 2 1/2" L. X 1/16" DIA.
BOAT, 1 3/16" X 1/2" X 3/16"
ENGINE WELL
5/8"
1 11/16"
5/32"
HULL SECTION AMIDSHIPS
ALL BLOCKS 1/16"
MAST, 4 1/2" HIGH
YARD 2 1/2" X 1/16" DIA.
BRACES BELAY AT DECK JUST FORWARD OF GANGWAYS
3 SHROUDS ON EACH SIDE
1/2"
1 1/16"
A
RUDDER BLADE AND STERN POST ARE 1/16" THICK
KEEL AND STEM, 1/16" SQUARE
12 3/8"
1/16"
1 5/8"
1/2"
4 1/8"
2 3/8"
1 1/2"
5/16"
3/32"
2 1/16"
1 1/4"
3/8"
PLANKING IS SCORED FULL LENGTH OF DECK
1 11/16"
15/16" SQ.
TILLER BAR 7/8" LONG
GANGWAY BOARDS 1/8" WIDE X 1/16" THICK
④
RAIL IS SOLID BETWEEN THESE POINTS

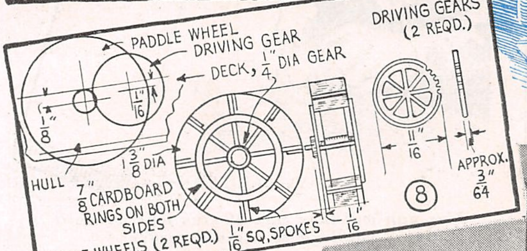

HAND RAIL, 1/16" HALF ROUND
ALL RAILS ARE 5/16" HIGH
STANCHIONS ARE 1/16" SQ
HULL AND DECK ARE SCORED TO REPRESENT PLANKING
⑤
9/32"
1 7/8"
PAINTED WINDOWS
1/16" HALF-ROUND MOLDING
CARDBOARD COVER AND DOORS
1/4"
15/16"
DECK HOUSE
⑥

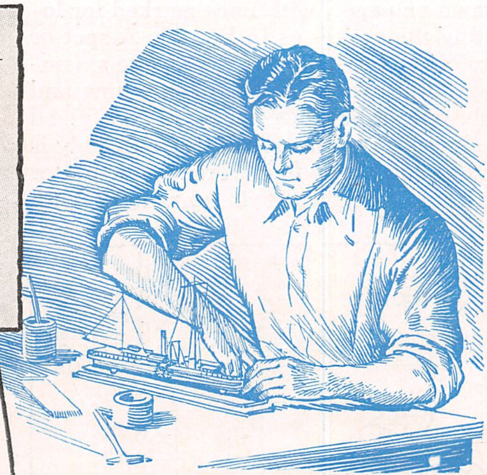
The pin heads are cut off, hammering-in producing a second "head" sufficient to hold well. Now, the entire assembly is given a coat of thin orange shellac, which is smoothed, after it has dried, with fine steel wool.

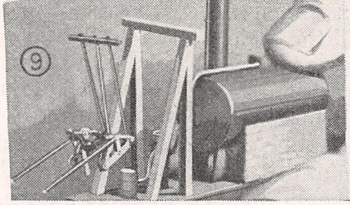
The forward and after deckhouses, with their hatchways, are made from white pine blocks as in Fig. 5. The forward deckhouse is the same construction but smaller. Thin match-box wood, or cardboard, is suitable for the hatch covers and doors, these being glued in place, after which 1/16-in. half round moldings are fitted and glued on as shown. The rudder and tiller bar, masts, yards and lifeboat can also be made at this time, but are not placed until later. Noting the color key, the parts just made are painted. The hull also can be painted as specified. Windows are light blue with black cross-bars and frames. Now, the deckhouses are set in place, the area marked on the deck and sanded, and the deckhouses permanently glued in position.

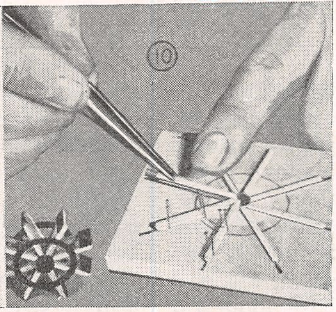
The boiler and engine assemblies are next, Figs. 7, 9 and 11. The former, with its base, is made from wood; the stack from 3/16-in. brass tubing (or a wooden dowel); the steam pipes from wire of a diameter proportional to that shown, Fig. 11. The engine cylinders are wooden dowels, the bell cranks are celluloid or cardboard and the connecting rods are wire. Boiler and engine units are all assembled


SMALL CYL. 5/16" X 3/32"
9/16"
PISTON GUIDE FRAME 3/32" SQ. WOOD
BELL CRANK 3/4" X 1/4" X 1/16"
1" X 3/16" DIA. CYLINDER
CARDBOARD BASE
13/16"
1/16"
WOOD BAR
1 9/16"
WIRE RODS
SET IN HULL
FRONT VIEW
⑦


PADDLE WHEEL DRIVING GEAR
DECK, 1/4" DIA GEAR
1/16"
1/8"
HULL
1 3/8" DIA
7/8" CARDBOARD RINGS ON BOTH SIDES
PADDLE WHEELS (2 REQD.) 1/16" SQ. SPOKES
1/16"
DRIVING GEARS (2 REQD.)
11/16"
APPROX. 3/64"
⑧







on a black cardboard base, cut to the area of the engine well, and the whole glued in place. On the full-size prototype the rods from the top of the bell crank join another crank on the driving gear shaft forward but this connection would be concealed by the cover set flush in the deck, Fig. 6, and instead, these rods are merely thrust into holes in the forward wall. The deck cover is then glued into place. Both open and solid rail parts are 1/16 in. in thickness, the stanchions being square and the top rails half round as in Fig. 5. To curve the top rails at the bow, a piece of scrap wood is cut to the curve of the deck and, leaving these top rail sections square, the pieces are boiled in water for a few minutes, quickly placed on the curve of the board and tied in place until dried out. They are then cut half round and fastened with model-airplane cement. The masts, with yards and sails, are now set up as shown in the side view, Fig. 4. The rigging is No. 35 black-linen thread throughout. Rudder and tiller bar are fastened to the hull with pins, the fittings being indicated with black paint. Pins also secure the shroud blocks at the deck, and chain plates are painted black on the hull in line with each shroud. The paddle-wheel driving gears are made from celluloid or cardboard. It is not advisable to use clock gears unless of the exact size specified, as these units are very prominent and should be held to scale. See Fig. 8.

To make the paddle wheels a circle is

COLOR KEY—"Clermont"

Light dull gray:
Hull, deckhouse roofs and doors, lifeboat exterior, paddle-wheel spokes, engine-well sides and rudder.

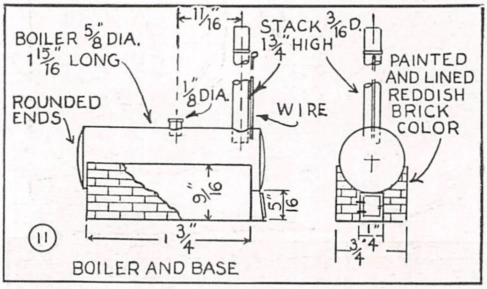
Orange shellac (dull):
Deck, masts and yards, piston guide frame, tiller bar and rigging blocks.

Dull white:
All rail units including insides of solid rails deckhouse, steps and interiors, linen sails, and lifeboat interior.

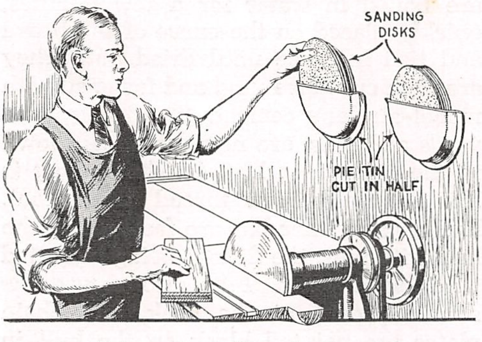
Dull black:
Boiler parts except base, engine parts except piston guide frames, paddle-wheel blades, gears, hubs, rings and driving gears, rigging lines, floor of engine well and painted-on chain plates and rudder fittings.

Miscellaneous:
Boiler base, brick red lined with dull gray; deckhouse and stern windows, light blue with black frames and cross-bars.

drawn on paper, with lines marked for locating the spokes as in Fig. 10. A spot or two of cement holds the first spoke assembly to the paper. The cardboard ring and hub, or paddle-wheel gear, is then glued to the spokes. The next spoke assembly is laid on top of the first, "bread-and-butter fashion," being kept in alinement with bank pins. After completing the four spoke assemblies thus, each pair is joined together with a wooden hub and the paddle blades. Paddles and driving gears are then attached to the hull with bank-pin shafts, the correct mounting being shown in the top view, Fig. 4, and mounting diagram, Fig. 8. The model is mounted on a base about 4 by 14 in. in size, small diameter wood screws being driven through the base and also through the ½-in. pedestals into the hull.


BOILER 5/8" DIA.
1 15/16" LONG
ROUNDED ENDS
1 1/16"
STACK 3/16" D.
1 3/4" HIGH
1/8" DIA.
WIRE
PAINTED AND LINED REDDISH BRICK COLOR
9/16"
5/16"
3/4"
1/4"
3/4"
11
BOILER AND BASE

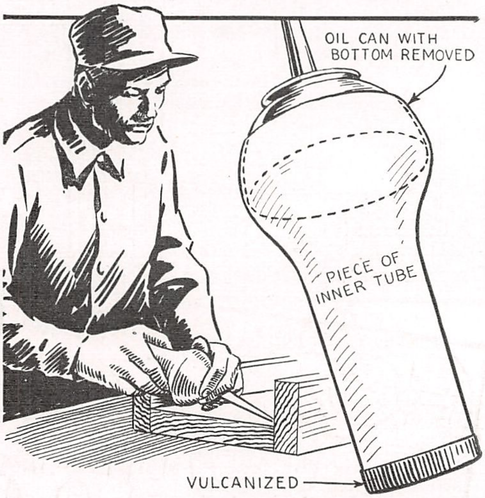
Sanding Disks Neatly Stored in Wall Racks


SANDING DISKS
PIE TIN CUT IN HALF

Sanding disks and grinding wheels are always at hand if kept in these holders

Nailed to the wall near your sanding machine, halves of pie tins provide neat holders for sanding disks. Also, the tins may be used for grinding wheels, and they can be obtained in a variety of sizes.

Glue Gun Handles Tricky Jobs


OIL CAN WITH BOTTOM REMOVED
PIECE OF INNER TUBE
VULCANIZED

This gun will take care of glue jobs where it is difficult to use a spreader

On several occasions you have probably had jobs when this gun would have come in handy for applying glue where it was difficult to use a spreader. The gun is simply an oilcan with the bottom cut away and fitted with a short section of inner tube as shown, the open end of the tube being cemented or vulcanized. The gun is filled by unscrewing the spout from the can and the glue is ejected by rolling up the end of the tube.

Jos. C. Coyle, Tucson, Ariz.

Protecting Stored Furniture

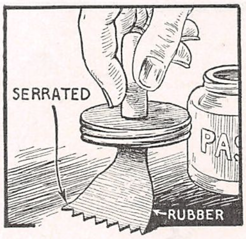
When storing furniture in an attic or storeroom, it is a good idea to wrap each piece completely in heavy paper, securely tied with strong wire. This will protect the surface against spots, stains or scratches.

Aid to Remove Rusted Screws

When removing a corroded screw where there is a possibility of splitting the head, try tapping the handle of the screwdriver lightly with a hammer as you turn it. The jarring of the ham-

mer combined with the twisting action of the screwdriver tends to break the corrosion so that the screw can often be removed quite easily.
—R. DeWitt Miller, Los Angeles, Calif.

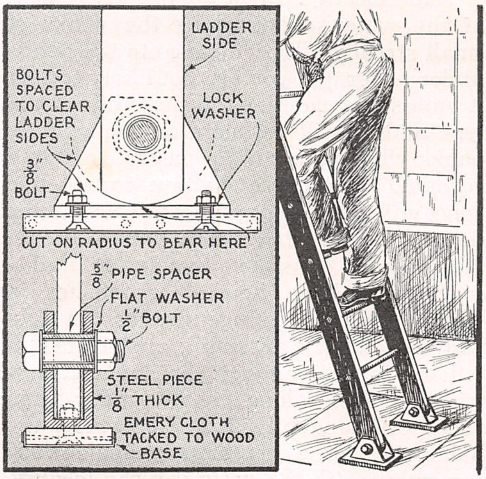
Paste Spreader Is Serrated to Increase Efficiency


SERRATED
PAS
RUBBER

Those who use library paste in their work will find that by serrating the lower edge of the rubber spreader they can cover the surface quickly. Also, there will be some saving in the quantity of paste required as the notches make it possible to apply the paste in a thin, even coating.

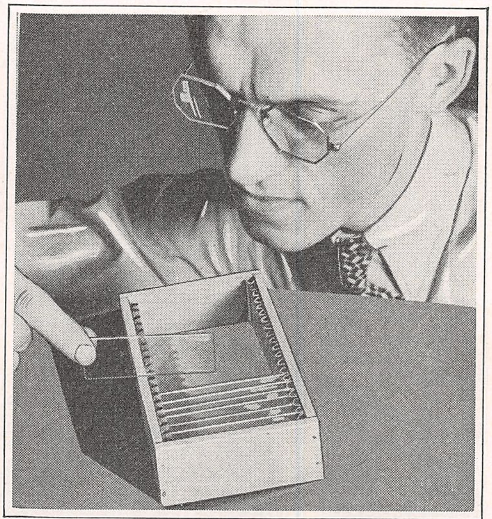
Self-Adjusting Ladder Feet Hold on Any Surface

Covered on the bottom with coarse abrasive cloth, these feet provide maximum bearing on any surface supporting a ladder and automatically adjust themselves to the required angle. The steel parts are easily cut with a hack saw and bent to shape while hot. Hardwood is best for the bases of the feet to which the abrasive cloth is tacked.


LADDER SIDE
BOLTS SPACED TO CLEAR LADDER SIDES
LOCK WASHER
3/8" BOLT
CUT ON RADIUS TO BEAR HERE
5/8" PIPE SPACER
FLAT WASHER
1/2" BOLT
STEEL PIECE 1/8" THICK
EMERY CLOTH TACKED TO WOOD BASE

These abrasive-cloth covered feet provide safe footing for a ladder on a hard surface

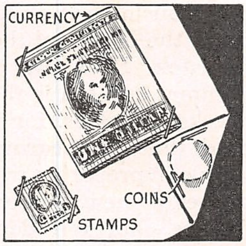
Microscope Slides Neatly Filed in Cardboard-Lined Box



Microscope slides are protected against dust and breakage in this container

Glued to the sides of a small box as shown, strips of corrugated cardboard provide a means of safely filing your microscope slides. When slipped into the corrugations of the cardboard, the slides are properly spaced so that they will not touch each other. The box, of course, should be just wide enough to take the slides loosely, and should be provided with a dustproof cover.

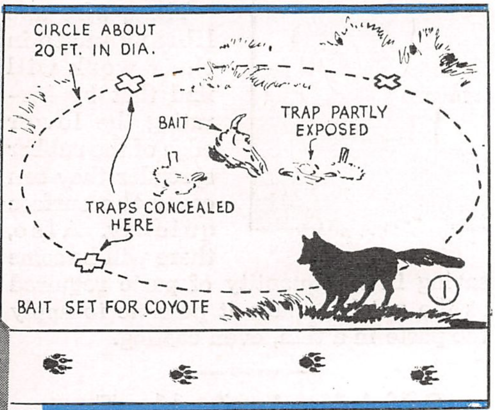
Mailing Coins and Stamps


CURRENCY
COINS
STAMPS

Here is a simple method of sending coins, currency and stamps through the mails with little chance of them getting out of the envelope. For a coin, just fold one corner of the letter over it and staple down the edges. For stamps and currency—the latter should be folded compactly—lay them on the paper and staple across opposite corners. The staples should not penetrate the stamp or currency, but just catch the corners as shown.—J. M. Brandon, Lorain, Ohio.

Outwitting the

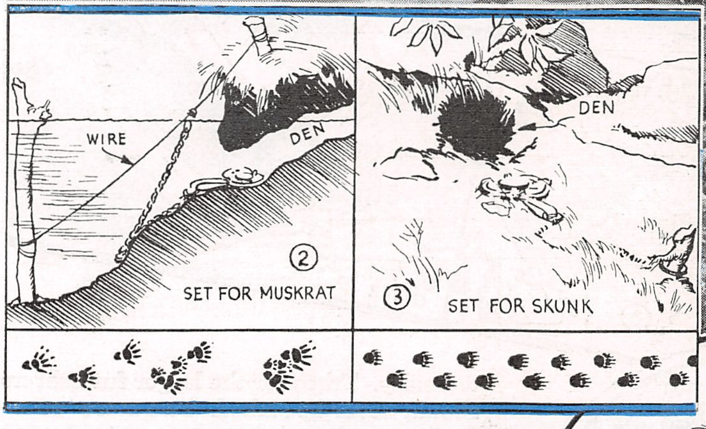
By Maurice H. Danvers



PELT hunters who know the tricks of the trade usually begin "prospecting" for fur long before the legal trapping season opens. The experienced trapper makes it his business to study constantly beforehand the doings of the animals he intends to catch. He knows that during the late summer and fall is the best time to locate tracks and dens, for it is during this period that fur-bearing animals are most active in preparing winter quarters. So he makes a mental note of all the muskrat "slides"—all the dens in the banks of streams on his prospective trap line. He checks up carefully on all "used" burrows of the smaller animals in the fields and woodlands of his locality. Then when the legal season opens he knows just where to set his traps to take valuable pelts.

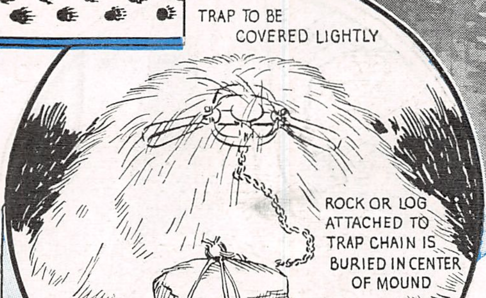
You'll find tracks of such smaller animals as the mink, along tiny, meandering streams in open country, in marshes and about the driftwood lodged along the banks of the larger creeks and rivers. While you're looking for mink, watch for the broad tracks of the raccoon where the stream passes through areas of heavy timber. You are likely also to find signs of opossum in the same locality. Look for muskrat tracks at the water's edge along the banks of small streams. The entrance to the den is under water and you are not likely to spot it unless you examine the shore line closely. "Slides" will be found on sloping clay banks where the stream passes close to a cornfield. These are shallow, trough-like concavities made by the animals sliding down the steep bank into the water. In marshes, the "rats" live in colonies, building mound-like "houses" of rushes in which they find refuge during the cold winter months. Fox, skunk, and civet signs will be found in rough, brushy territory with the dens along fences, under large rocks or along hillsides. Of course, the habits of these common animals vary somewhat with the nature of the locality. The coyote usually prefers the open plains

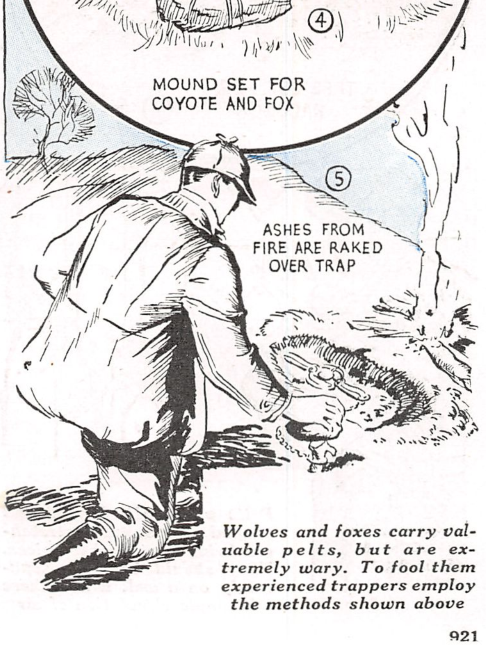
FUR BEARERS


WIRE
DEN
②
SET FOR MUSKRAT
DEN
③
SET FOR SKUNK

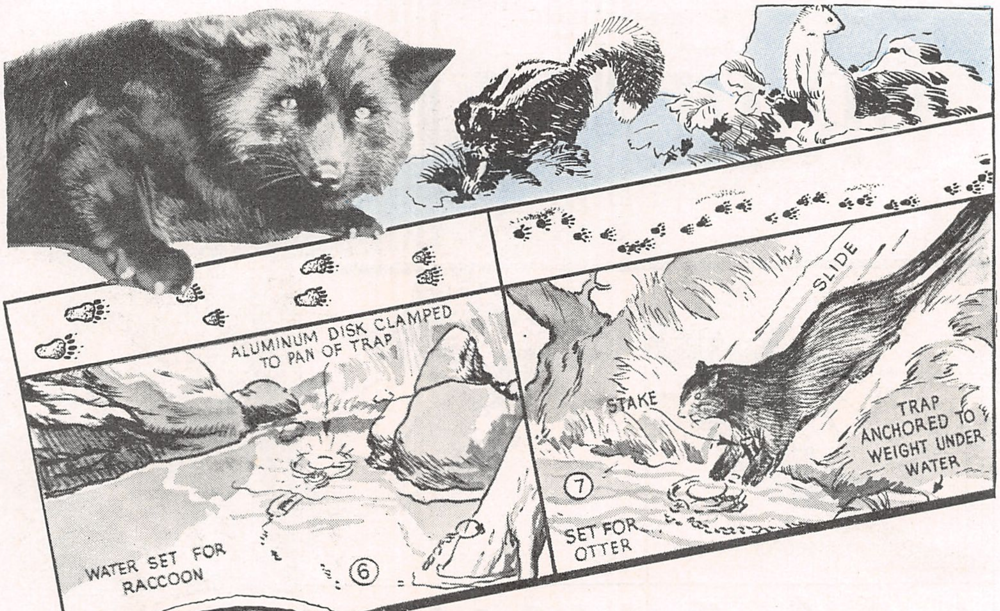
but is also found in mountainous sections. Some fur bearers, such as skunk, hole up during severe cold weather, while others, the mink, for example, will be found abroad the year 'round.

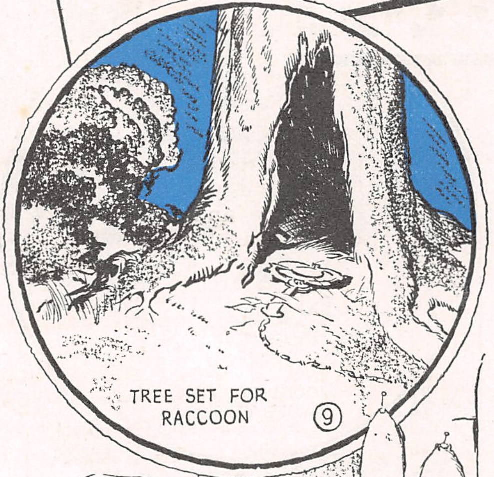
Now to make the sets. Bright, new traps should be buried in the damp ground for a week or so, to color with rust. Whenever possible, sets should be made in the water, for this destroys the human scent which wary animals quickly detect and avoid. When sets are made on land the traps are covered with a light material which will not clog the triggers. The important thing in making a concealed land set is to use covering material native to the locality, that is, if the set is made among dry leaves, use these to cover the trap. Carry a small wad of cotton or wool to place under the trap pan. Fig. 1 shows a practical bait set for coyote and fox. Offal from the local slaughter house is just the thing for bait. You will see that a couple of traps are placed carelessly near the luré, but in a circle roundabout three or more traps are very carefully concealed. These animals are extremely wary and you must be clever if you are to fool them. Have your traps chained to drags—a log or stone of such weight that the animal, if caught, can drag it only with

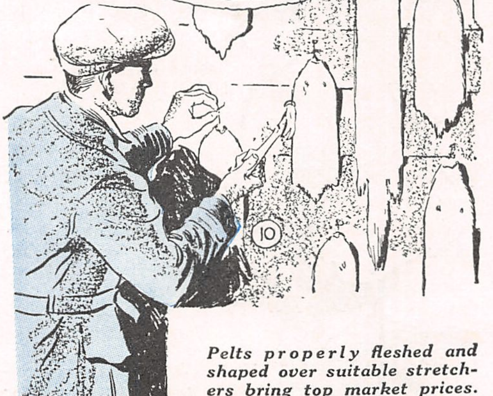

TRAP TO BE COVERED LIGHTLY
ROCK OR LOG ATTACHED TO TRAP CHAIN IS BURIED IN CENTER OF MOUND
④
MOUND SET FOR COYOTE AND FOX


⑤
ASHES FROM FIRE ARE RAKED OVER TRAP

Wolves and foxes carry valuable pelts, but are extremely wary. To fool them experienced trappers employ the methods shown above


ALUMINUM DISK CLAMPED TO PAN OF TRAP
WATER SET FOR RACCOON
6
SLIDE
STAKE
TRAP ANCHORED TO WEIGHT UNDER WATER
7
SET FOR OTTER

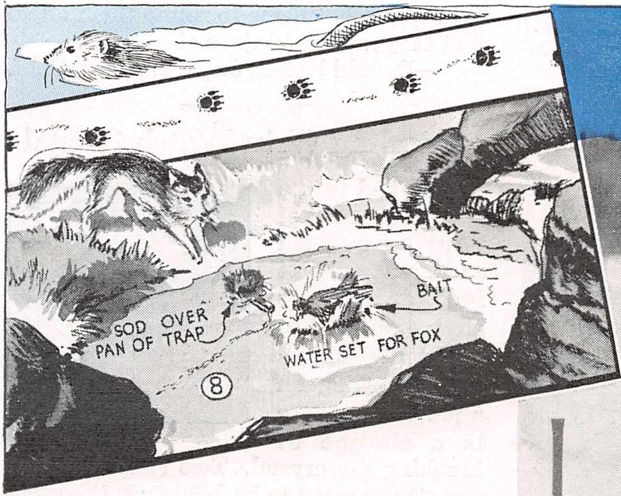




Pelts properly fleshed and shaped over suitable stretchers bring top market prices. They should be hung separately on a wall where there is ample circulation of air

difficulty. Traps for the larger fur bearers should never be staked. Two more "surefire" sets for these same animals are shown in Figs. 4 and 5. The former is particularly effective for fox, as these animals like to survey the countryside from an eminence. The latter is best for both coyote and wolf, because of the habit of digging in old campfires. To make the first set, a load of barnyard manure dumped in the center of a field away from habitations is just the thing. Conceal a large stone or a log at the edge of the mound and leave undisturbed for a week or more. Then carefully set a trap as shown and attach the chain to the drag. No bait is used. To make the second set, build a fire in some locality the animals are known to frequent. Then, beside the fire make a shallow excavation just deep enough to drop the trap and drag below the level of the ground. While you're doing this throw a few scraps of meat into the fire. Remove to some distance all the fresh soil from the excavation and set the trap. Then rake the ashes of the fire over it, taking care that these do not clog the trigger. The ashes should fill the excavation slightly above the ground level.

Fig. 2 shows a typical set for muskrat at the underwater entrance to the den along stream banks. The important thing here is to see that the wire holding the

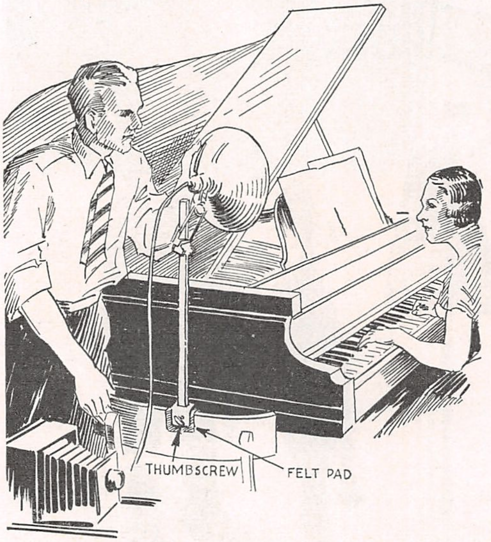


trap chain leads to deep water, so that when the animal is caught it will drown at once. This also holds when making water sets for beaver and otter. One trick in taking otter is shown in the set made as in Fig. 7. A short stake is driven into the slide about 16 or 18 in. above the water's edge. In coming down the slide these animals fold the front legs under the body. When they strike the stake the front legs are naturally thrown forward—and into the trap. Experienced trappers take beaver by making breaks in the dams at the water's edge. Traps concealed in these openings catch the animals as they set about making repairs.

In most localities skunk and opossum can be taken easily with the den set as in Fig. 3; also the hollow-tree set in Fig. 9 will catch the opossum if the den shows signs of being "used" by this animal. One of the simplest and best sets for raccoon is shown in Fig. 6. Here the trap is buried in the sand at the water's edge and a small disk of aluminum or other non-rusting bright metal is clamped to the pan of the trap. The raccoon is something of a fisherman and he has the habit of striking at any bright object that flashes underwater. Thus you catch him with this simple trick. Another water set that will take pelts is shown in Fig. 8. The set can be made in either a stream or a spring—better the latter, unless you can find a small pool or eddy in a creek or river. An attractive bait is placed on a rock about 3 ft. from shore, and half way between the bait and the water's edge you build up an "island" of mud and stones for the trap. Cover the trap lightly with a piece of sod. In trying to get the bait, the animal, not liking to wet its feet, will step on the sod hiding the trap. This set has been found to be especially good for catching fox.

Pelts should be fleshed after skinning, shaped over suitable stretchers and hung on a wall where there is ample circulation of air, as in Fig. 10. Furs that are properly handled after taking, bring top prices on the market. To bring the highest prices, pelts not only must be properly cured, but they must reach the buyer in good condition. One trapper recommends packing hides with the flesh side out, using strips of cured birch bark, or heavy cardboard dividers, to prevent sweating. In shipping by mail, he provides plywood backing sheets for the bundles to keep the hides flattened. If the pelts have been exposed to freezing weather see that they are properly dried before shipping. Remember, too, that the laws governing the trapping of certain animals in the various states and provinces are very rigid due to scarcity of the animals in question. Practically all states require a trapping license. Know the law before you set your traps.

Clamp-On Photoflood Lamp Improved by Standard

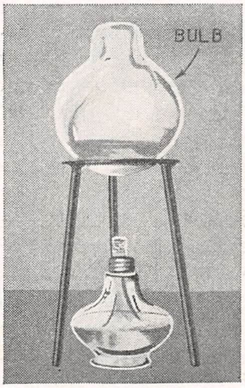


By using this simple standard your clamp-on photoflood lamp is made adjustable in height

I find that a simple extension standard for the popular clamp-on type of photoflood lamp improves the latter as the lamp can then be clamped to any object and adjusted in height. The standard is simply a U-shaped piece of brass drilled and tapped on one side for a thumbscrew and screwed to the end of a length of broomstick. In use the standard is fastened to a chair or other object and the lamp is clamped at any desired height on it.

—Arthur Trauffer, Chicago, Ill.

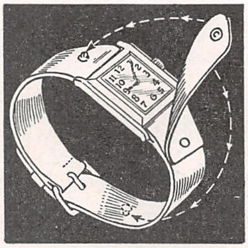
Inexpensive Chemistry Flasks from Old Bulbs



By simply removing the necks from large, burned-out electric bulbs, the amateur chemist can obtain a supply of inexpensive flasks. The necks can be cut off by any of the methods used in cutting bottles, after which the sharp edges of the flasks should be held over a hot flame to round them off so that they will not injure the hands.

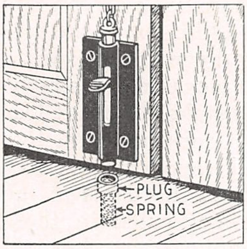
—Donald Himes, Jr., Richmond, Calif.

Shielding Wrist-Watch Crystal



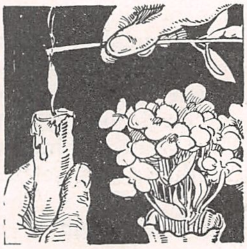
Riveted to the leather bracelet of your wrist watch as shown, a short leather strap is always at hand to shield the watch when working on a job where there is a chance of breaking the crystal. Two snap fasteners permit the strap to be held over the crystal or fastened to the bracelet.

Door-Bolt Holes in Garage Floor Kept Clean by Spring Plugs



When holes are made in floors of garages, shops and other buildings to take sliding bolts, which hold open double doors, these spring plugs will keep dirt from filling the holes. The plugs are short pieces of iron rod held flush with the tops of the holes by small coil springs, which depress when the bolts are inserted to hold the doors.

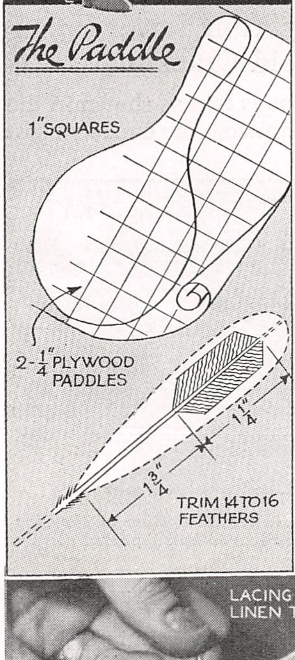
Cut Flowers Will Last Longer if Stems Are Singed



If the stem ends of a bouquet of cut flowers are singed slightly, it is claimed that they will last longer than when just cut and put in a vase of water. Singeing closes the pores in the stems so that the liquids inside do not escape, thus keeping the flowers in a fresh condition.

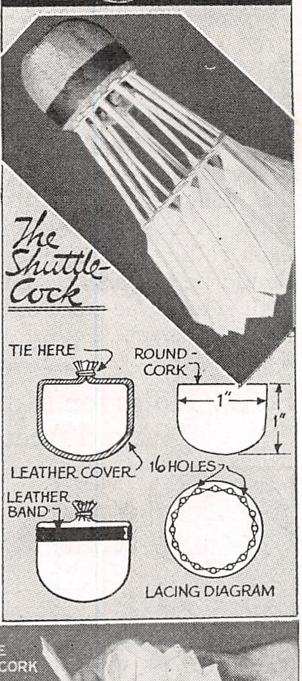
Indoor BADMINTON

It takes fast footwork, accuracy of eye and hand, and split-second mental calculation to play this fascinating indoor game. Two paddles and a shuttlecock are all the equipment you need, as no net is used indoors. It takes but a few minutes to lay out and saw the paddles to shape from ¼-in. plywood. Round the sawed edges and sand smooth. Stain both sides of the paddle to match and finish with shellac. The base of the shuttlecock is a piece of cork, 1 in. diameter and 1 in. long. One end is rounded on a sanding disk, then the cork is covered with chamois, stretched tight and tied as shown. A ¼-in. leather band is cemented to the chamois near the top of the cork. After clipping from 14 to 16 feathers to the shape shown at the left, you press these into holes punched in the cork, dipping the quill of each feather in rubber cement before inserting. Adjust the tips to form a circle about 3 in. in diameter, then lace together with linen thread as shown. Paint the thread with celluloid cement. In playing the game, two contestants stand 15 or 20 ft. apart and bat the shuttlecock back and forth. Misses and bad serves count one point each and 21 points constitute game



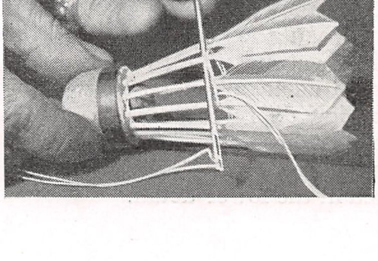
The Paddle

1" SQUARES
2-¼" PLYWOOD PADDLES
1¼"
1¾"
TRIM 14 TO 16 FEATHERS

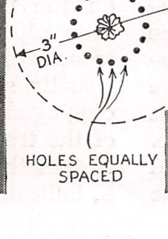


The Shuttle-Cock

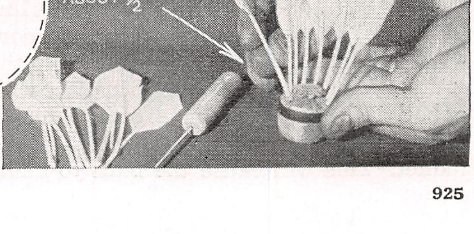
TIE HERE
ROUND-CORK
1"
1"
LEATHER COVER
16 HOLES
LEATHER BAND
LACING DIAGRAM



LACING WITH LINEN THREAD

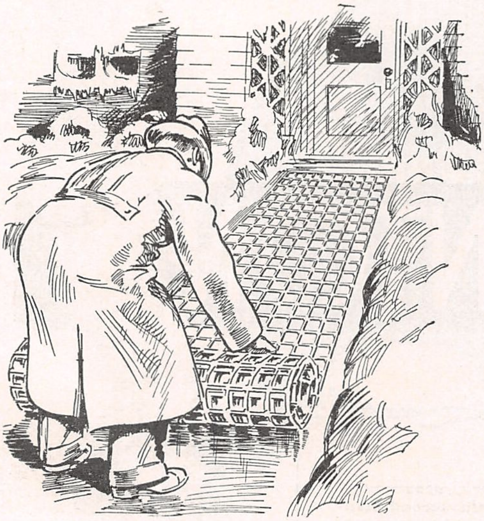


LAP FEATHERS
3" DIA.
HOLES EQUALLY SPACED



FEATHERS ARE FORCED INTO CORK ABOUT ½"

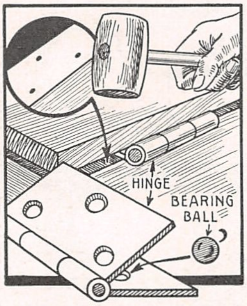
Non-Skid Mat on Icy Sidewalk Offers Firm Footing



Instead of spreading icy walks with salt or ashes, which are tracked into the house, one home owner uses a length of wire fencing

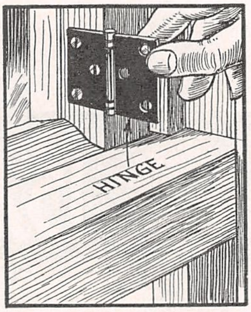
As a precaution against accidents when the sidewalks are icy, one home owner keeps a roll of woven fencing wire on hand and spreads it over his walk on days when rain or melting snow freezes. It's best to have the wire 4 or 5 in. wider than the sidewalk so that it can be staked down at the corners, which prevents it from rolling up at the ends. The stakes should be driven well into the ground on each side of the walk so that nobody will trip over them.

Screw Holes for Mounting Hinge Marked Accurately



To accurately mark the locations for drilling screw holes when hinging lids to boxes and similar work, try using a few small steel bearing balls. Just line up the work correctly and slip the hinge in place with a ball in each screw hole of the hinge. Then strike the work lightly with a wood mallet. This will cause the balls to make slight impressions in the wood exactly where the screw holes should be drilled.

Substitutes for Window Locks

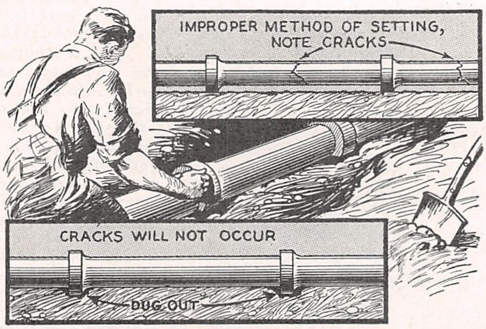


As a substitute for window locks, try using butt hinges as indicated. Mount the hinge on the upper sash so that the lower sash will pass when the hinge is folded. By mounting the hinge a little higher than shown, it will serve to keep out intruders when the window is raised slightly at night for ventilation. If small hinges are used, they will be unnoticeable behind curtains.

—Robert J. Bailie, Flushing, N. Y.

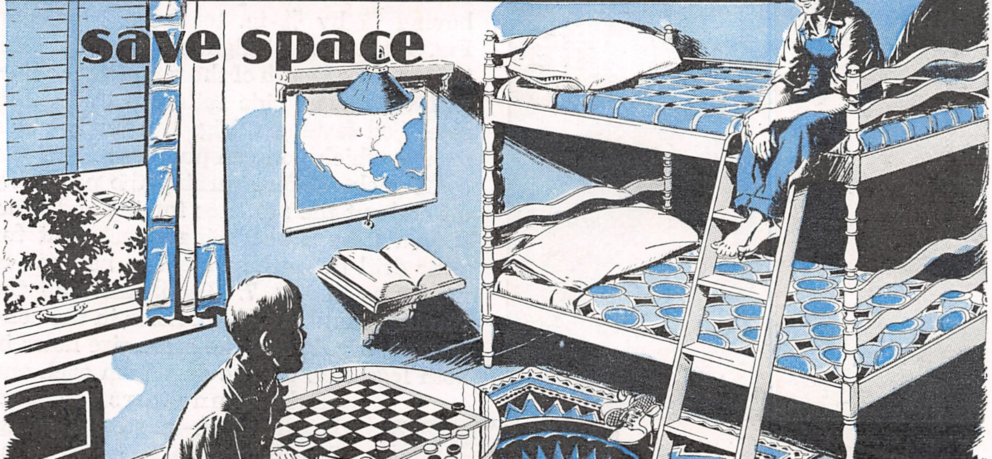
How to Lay Your Sewer Pipe to Avoid Cracking

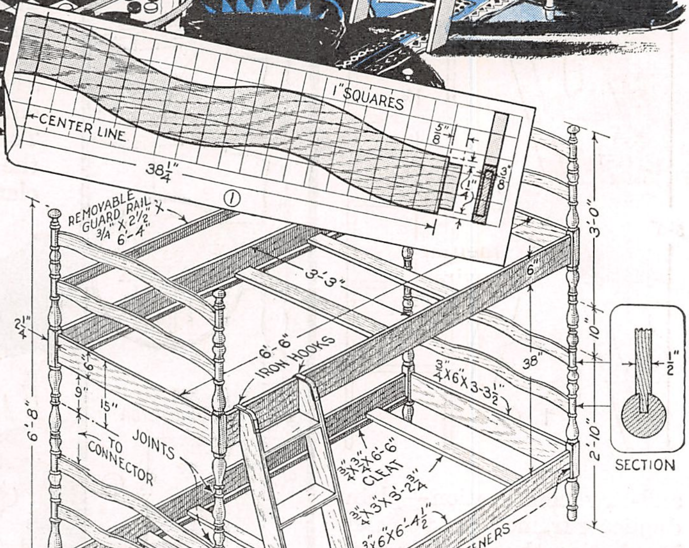
When sewer pipe is laid as shown in the top detail of the drawing, the entire weight of the line is carried at the few points where the bell ends of the pipe touch the bottom of the trench. This puts a strain on the unsupported center portions of each pipe when the dirt settles in the trench, often causing the pipes to crack. Usually such damage can be avoided by digging shallow depressions in the bottom of the trench where the pipe joints come so that the entire sewer line is supported as indicated in the lower detail.



Shallow depressions in trench bottom at the pipe joints allow the entire line to be supported solidly

"Twin-Deck" BEDS save space

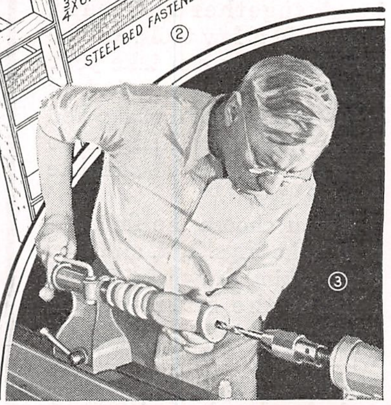



1" SQUARES
CENTER LINE
38 1/4"
5/8"
3/4"
1"
①
REMOVABLE GUARD RAIL 3/4" X 2 1/2" X 6'-4"
3'-3"
6'-6"
IRON HOOKS
2 1/4"
6"
9"
15"
6'-8"
TO CONNECTOR
JOINTS
3/4"X6"X3'-3 1/2"
3'-0"
6"
10"
38"
2'-10"
3/4"X3/4"X6'-6" CLEAT
3/4"X3"X3'-2 3/4"
3/4"X6"X6'-4 1/2"
STEEL BED FASTENERS
②
3'6"
MORTISED
9"
15"
1/2"
SECTION

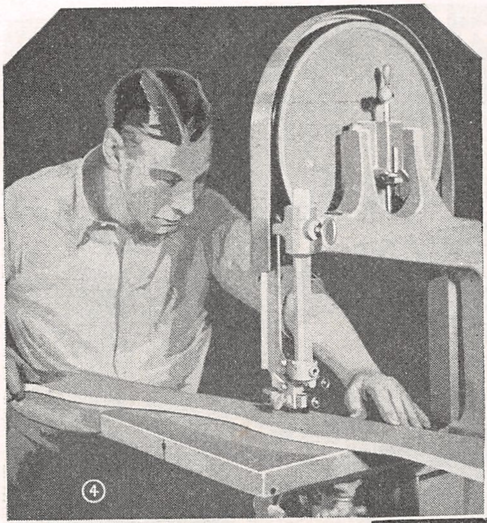
By R. O. Buck

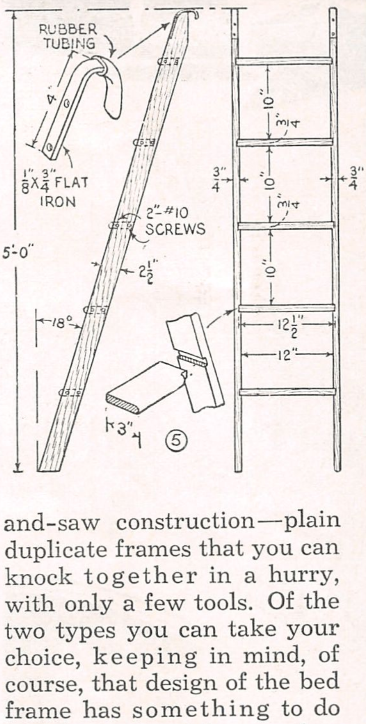
IF YOU'RE planning a boy's room, a den, or a spare room in the attic, a double-deck bed often fits right into the scheme. In the small room it economizes space; in the larger room it gives just the touch of novelty you are looking for. It's easy to imagine you're in camp when you climb the ladder to the upper "bunk." And, if you wish, the double-decker can be made so that it can be taken apart quickly and used as two separate twin beds.

Figs. 1, 2, and 6 detail the construction of the "ladder-back" type of double frame, a rather elaborate affair that involves turning and band-sawing. On the other hand, the type detailed in Figs. 8 and 9 reduces things to the fundamentals of hammer-



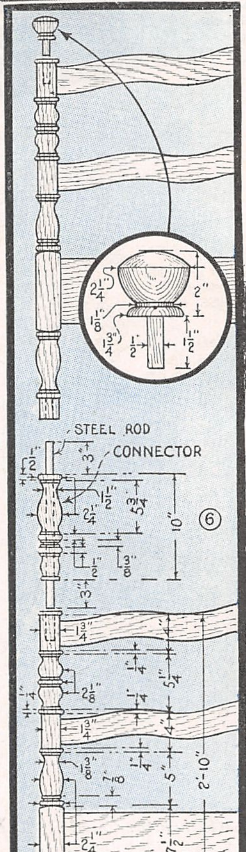
If you're fitting out a spare room with furniture made in your own shop you'll appreciate the ease of construction and space-saving features of this double-deck bed. The curved "ladder" rails duplicate a motif which originated in early colonial days



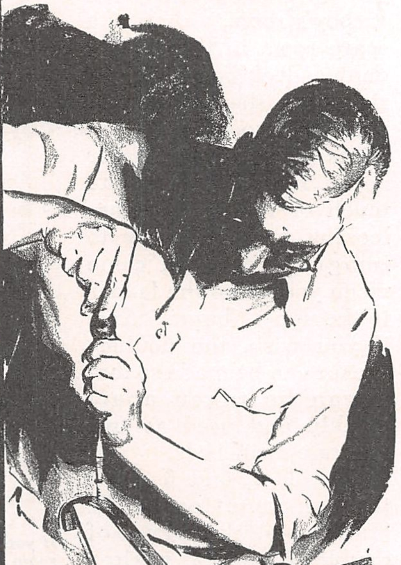

RUBBER TUBING
4"
1/8" X 3/4" FLAT IRON
2" #10 SCREWS
2 1/2"
5'-0"
18°
3"
10"
3/4"
10"
3/4"
10"
3/4"
3/4"
12 1/2"
12"
⑤

and-saw construction—plain duplicate frames that you can knock together in a hurry, with only a few tools. Of the two types you can take your choice, keeping in mind, of course, that design of the bed frame has something to do with harmony of the complete furnishings.

If you choose the first design, take Figs. 1, 2, and 6 as the working drawings. Notice right at the start that the corner posts are duplicates with only one exception: The top posts are drilled at both ends for dowels, as in Fig. 6.

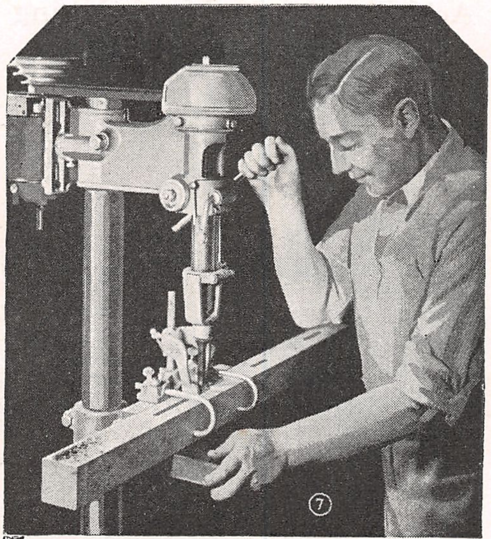

2 1/4"
2"
1 1/8"
1 3/4"
1/2"
1 1/2"
STEEL ROD
CONNECTOR
1/2"
3"
1 1/2"
5 3/4"
10"
2 1/4"
1/2"
3/8"
3"
⑥
1 3/4"
1/4"
5 1/4"
4"
2 1/8"
1/4"
1/4"
1 3/4"
4"
1 3/8"
7/8"
1/4"
5"
2'-10"
2 1/4"
7 1/2"
1/2"
2 1/4"
5/8"
1 3/8"
8 1/4"
1 3/4"
1 1/2"

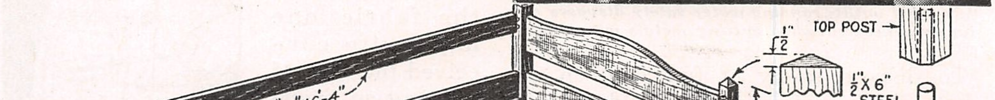
All other parts, side and end rails, ornamental "ladder" rails and connectors are in duplicate. End rails and the ladder rails are mortised to the posts, the curved rails having 3/8 by 5/8-in. tenons as shown in Fig. 1, and the straight rails 3/8 by 1-in. tenons. The length of the tenons, of course, will vary. The side rails are fitted with steel bed fasteners, Fig. 1, a ready-made fixture which you can purchase for a few cents each. Before turning the posts, lay off and cut the mortises for the end rails. If you have a mortising attachment for your drill press the work can be done in a jiffy as in Fig. 7. Then, make all the turnings and bore 1/2-in. holes in the connectors, Fig. 3, and the same size holes in both legs, Fig. 6. The dowels in each end of the connectors are short lengths of 1/2-in. steel shafting. The ladder rails have to be laid out with care, then sawed to shape on the band saw as in Fig. 4. Tenons are, of course, cut before sawing the curves. To assemble, glue the rails to the posts and draw up with bar clamps. Be sure to wipe off all

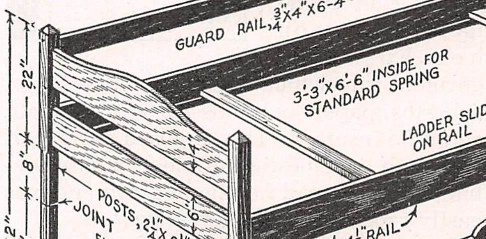


surplus glue from the joints. Screw cleats to the long rails to support the ends of the slats. With this done, all you have left to complete the job is the guard rail and the ladder, the latter being fully detailed in Fig. 5. The ends of the former are fitted with wire hooks dropping into screw eyes turned into the posts as in Fig. 8.

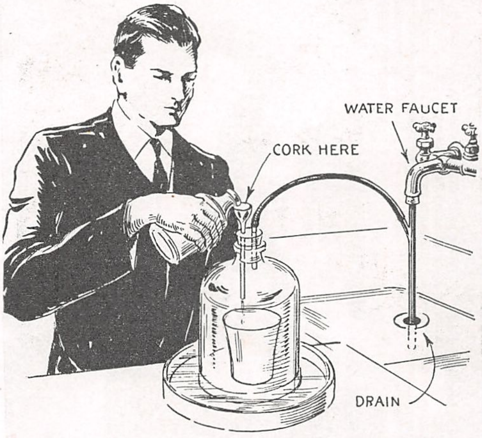
Now, the plain "two-decker" is assembled in the same way, only there's less work to do in making the parts, as you will see from Figs. 8 and 9. Posts are simply squares, faced on four sides, chamfered as shown, then cut and fitted with a loose metal dowel. If power tools are lacking you can make the whole thing by hand. Birch or maple are the best woods to use for either bed, as you can finish in maple or stain walnut or mahogany to match other furniture. If you use either of these stains on birch or maple it's generally best to apply a heavy coat on all the large surfaces. Then with a soft cloth, wipe off the surplus stain until you get just the shade of color you want. A nice "honey" color on maple can be secured by painting the work with a saturated solution of potassium bichromate, followed by several coats of thin shellac and a finishing coat of wax. The shellac should be sanded lightly before applying the wax.




GUARD RAIL, 3/4"X4"X6'-4"
3'-3"X6'-6" INSIDE FOR STANDARD SPRING
LADDER SLIDES ON RAIL
POSTS, 2 1/4"X 2 1/4"
JOINT
END RAILS MORTISED
3/4"X9"X3'-1 1/2"
3/4"X6"X6'-4 1/2" RAIL
SPRING SLATS, 3/4"X3"X38 3/4"
3/4"X6"X3'-3 1/2"
3/4"X9"X6'-4 1/2"
6'-2"
22"
8"
18"
17"
9"
4
6
9
2'-6"
3'-8"
6
9"
TOP POST
1/2"
1/2"X6" STEEL PIN
3/4"
2 1/4"
2 1/4"
2 1/4"
1/4" 1 3/4" 1/4"
BOTTOM POST
CHAMFERED
HOOK AND SCREW EYES
GUARD-RAIL FASTENING
⑧


1"SQ'S.
6"
18 3/4"
9
9"
6"
ALTERNATE RAIL DESIGNS, 1"SQUARES
6"
18 3/4"
9"
3/8"X1"X4" TENON
2 1/4"
POST
STEEL PLATES MORTISED IN
3/4"
RAIL
6"
STEEL HOOKS
⑨

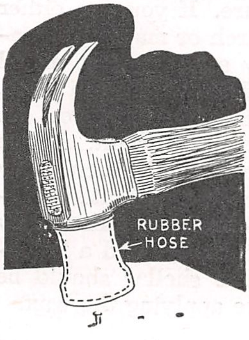
Acid Fumes from Metal Cutting Drawn into Sink Drain



With this outfit, running water safely disposes of fumes generated when cutting metals with acids

To dispose safely of fumes given off when cutting metals, such as gold and silver, with acid, I use the outfit shown, which carries the fumes to the sewer. The container holding the metals is set in a shallow glass tray of water, and a glass jug, or large bottle, with the bottom removed is placed over it, the water serving as a seal to prevent escape of fumes at this point. A length of glass tubing with a flared end inserted into the jug stopper permits pouring the acid onto the metal, and is corked to prevent the escape of fumes. A second tube through the stopper takes a length of rubber tubing, which connects the jug to a Y-shaped glass tube at a water faucet, one arm of the tube fitted with a cork to press inside the faucet tightly.—R. W. Thayer, Cleveland, Ohio.

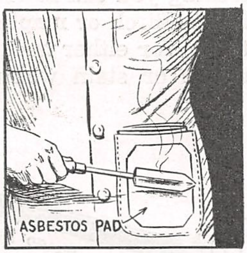
Rubber Shield on Hammer Head



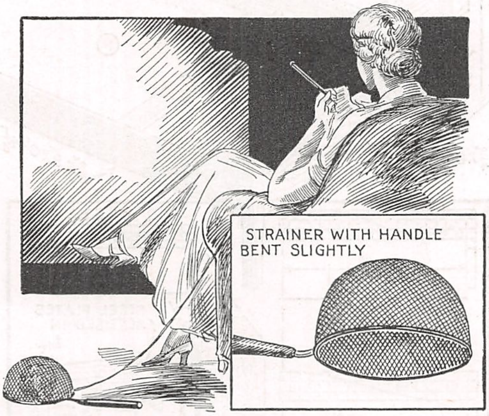
As the job of driving finishing nails in woodwork without leaving dents with the last blow or two of the hammer is an art many amateur carpenters haven't acquired, they can solve the problem by slipping a short length of hose over the hammer head. When the hose is cut off squarely so that it extends about $^3/_{16}$ in. beyond the face of the hammer, it will absorb any blow struck at an angle, which would be likely to cause a dent in the work, yet does not interfere as long as the nail is struck squarely.

Workman Cleans Soldering Iron on Asbestos Pocket

Anyone who has watched a mechanic at work with a soldering iron has observed that a large percentage of them will wipe the iron on their jacket sleeve or overalls. As this sooner or later burns a hole in the fabric, one housewife conceived the idea of sewing an open-faced pocket on her husband's garment into which several thicknesses of asbestos paper or folds of cotton cloth could be inserted. This exposed surface of the cloth or asbestos provided a safe and handy wiping pad for the hot iron and was easily replaced when necessary.

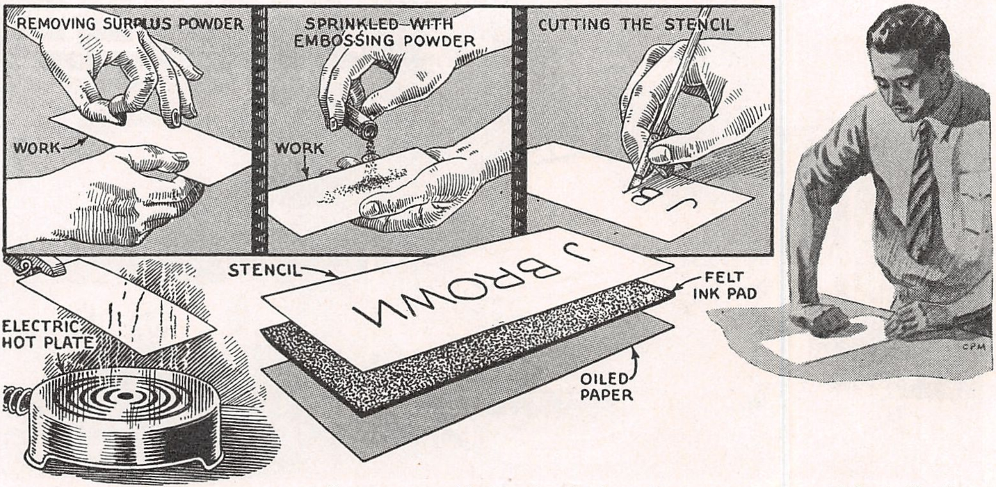


Knitting Yarn Held in Place under Inverted Strainer


STRAINER WITH HANDLE BENT SLIGHTLY

Why let your ball of yarn roll over the floor and entangle with the chair legs when you knit? Just invert a large vegetable strainer over it and it will stay in place. Also, the strainer makes a good holder for the ball when you lay down the knitting for a few minutes

Cards Are Embossed in Color with a Stencil



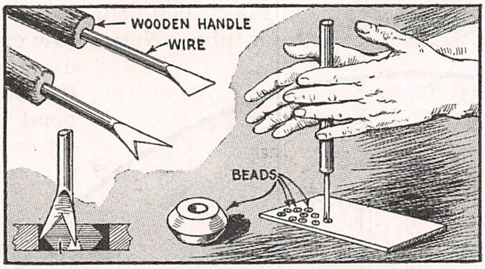
If you are unable to print the lettering or monogram satisfactorily, it can often be traced on the stencil from a card, magazine or other source

With this inexpensive method, anyone can letter or monogram valentines, calling cards, Christmas cards, etc., in raised gold, silver and other colors. The only materials needed are a mimeograph stencil, a piece of thin felt, a small amount of good embossing powder, yellow printing ink and some clear varnish. After cutting the lettering or design on a small piece of the stencil with a stylus, saturate the piece of felt with ink and add about four drops of varnish, spreading it evenly over the cloth. Put the stencil upside down on the felt so that the lettering will appear in reverse and lay the assembly on a flat board on a piece of oiled paper, fastening the whole with thumbtacks. Take a few trial impressions on a piece of paper by laying it on the stencil and rubbing it lightly with your hand. Often the stencil must be retouched, which can be done without removing from the pad. Simply take a needle and scratch the stencil lightly where the broken lines appear. If the impressions are clear, print the cards, allow them to dry about 15 min. and sprinkle on some embossing powder. Remove the surplus by tapping the card with your finger and apply heat to fuse the powder with the ink. An electric hot plate is best for this, but it can be done over a flame if care is taken not to scorch the card.

—M. G. Winterton, Fort Lewis, Wash.

Novel Drill Cuts Wood Beads

Copying a tool used by some South Sea Islanders in making their wood ornaments, the craftsman can use it to turn out beads for novelty jewelry, bearings and bushings for models, toys, etc., from plastics and various hardwoods. The tool is simply a short piece of heavy wire flattened at one end and shaped to suit, the cutting edges of the tool being sharpened. The tool can be fitted with a round handle and turned between the palms, or it can be chucked in a hand drill.



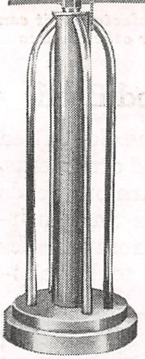
Improvised drill cuts ornaments for wood novelties, toys, models, etc.

—Goeffrey Archbold, Cleveland, Ohio.

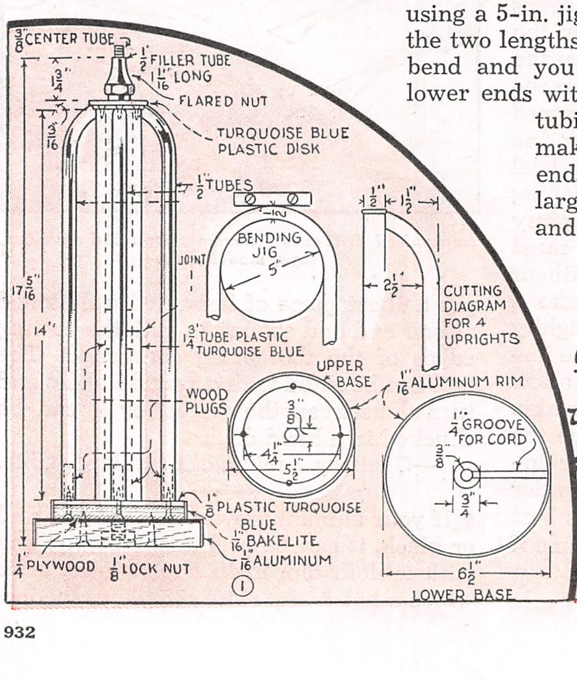
¶If your aluminum ware has become dull or black, it can be brightened by rubbing with a cloth dipped in lemon juice, after which a hot-water rinse completes the job.

The Latest TABLE

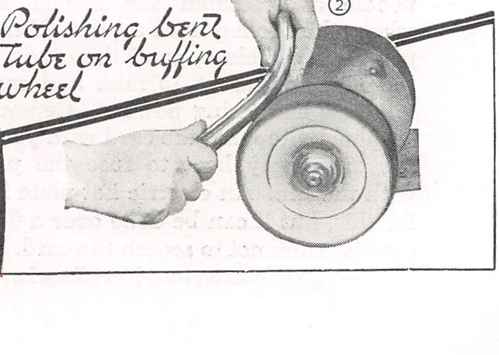
By Walter T. Warde



HAND wrought from brilliantly colored plastics and polished metal, these lamp bases of exclusive design will appeal to the craftsman who has a flair for modern home furnishings. Take the first two, shown at the upper left, and detailed in Figs. 1 and 4. The construction is very similar. You commence with the base in each instance, cutting it to shape and then gluing on overlays of plastics as in Fig. 9. Always cut the overlay disks a trifle larger than the wood base, then file down flush after they are glued on. You can use casein glue or metallic cement as adhesive for either Bakelite or aluminum. In making the base detailed in Fig. 1, you drill screw holes in the upper half for the upright aluminum tubes. Notice how easily the tubes are bent in the detail in Fig. 1, using a 5-in. jig. When the bending is finished, saw the two lengths of tubing in half at the center of the bend and you have the four uprights. Plug the lower ends with hardwood. Two lengths of plastic tubing may be cemented together to make the center column. Square the ends to a perfect fit, then join with a large dowel. Now true up to exact length and plug both ends with hardwood. Cen-


3/8" CENTER TUBE
1/2" FILLER TUBE 1 1/16" LONG
1 3/4"
FLARED NUT
3/16"
TURQUOISE BLUE PLASTIC DISK
1/2" TUBES
1/2"
BENDING JIG
5"
JOINT
17 5/16"
14"
1/2"
1 1/2"
2 1/2"
CUTTING DIAGRAM FOR 4 UPRIGHTS
1 3/4" TUBE PLASTIC TURQUOISE BLUE
UPPER BASE
1/16" ALUMINUM RIM
WOOD PLUGS
3/8"
4 1/4"
5 1/2"
1/4" GROOVE FOR CORD
3/8"
3/4"
1/8" PLASTIC TURQUOISE BLUE
1/16" BAKELITE
1/16" ALUMINUM
1/4" PLYWOOD
1/8" LOCK NUT
6 1/2"
LOWER BASE

①

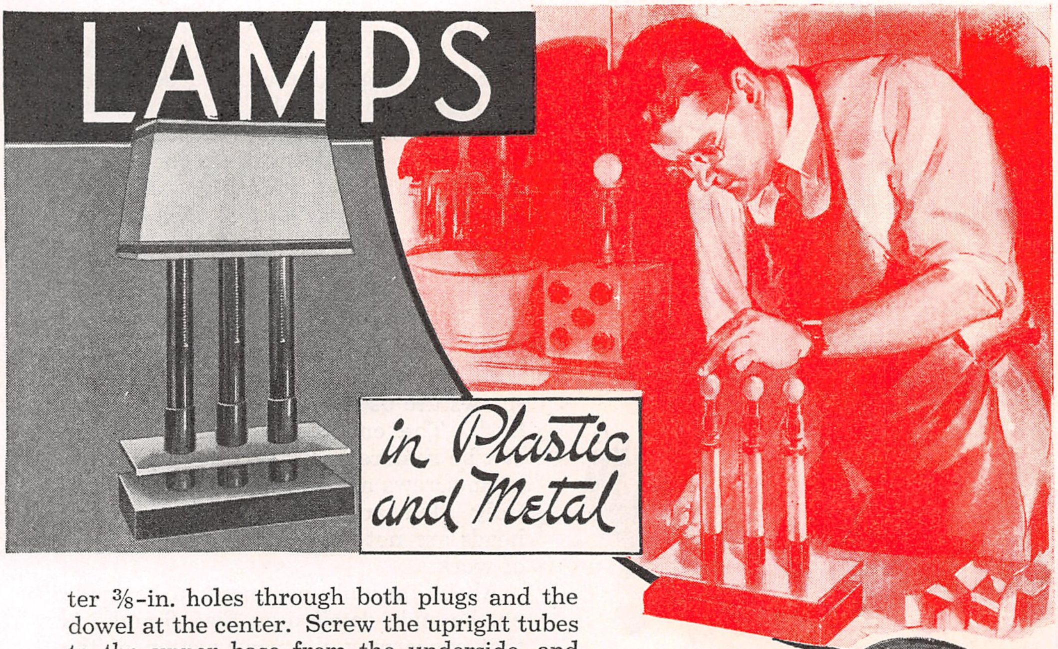


Polishing bent tube on buffing wheel

②

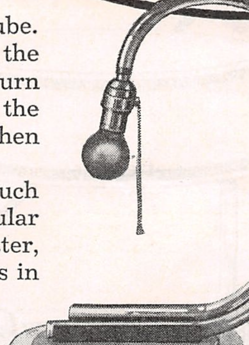
LAMPS

in Plastic and Metal



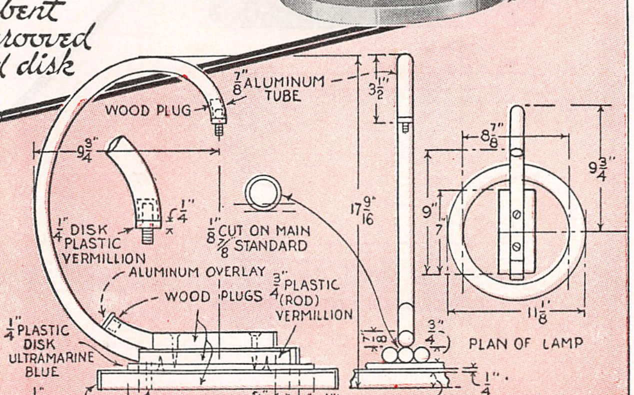
ter 3/8-in. holes through both plugs and the dowel at the center. Screw the upright tubes to the upper base from the underside, and also screw them into position at the top of the center tube. Thread a 3/8-in. brass tube at both ends, insert it in the holes drilled in the plugs within the center column, turn down a flanged nut on the top end and a lock nut on the bottom to draw the whole assembly together tightly. Then screw the lower half of the base to the upper.

Assembling the base detailed in Fig. 4 is done in much the same way except that you have to be more particular with the main tube or "gooseneck." In bending the latter, and also the short decorative tube, you use a 7-in. jig as in Fig. 3. Fill the gooseneck with dry sand and plug the ends. Now note that the portion of the tube which

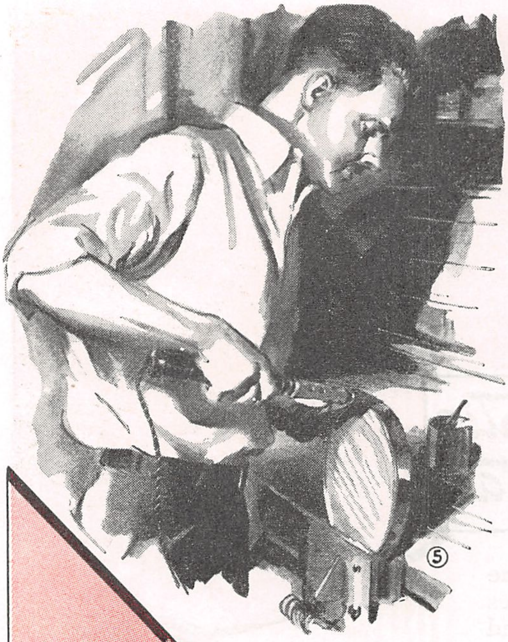


Tubing is bent around a grooved hardwood disk

③


7/8" ALUMINUM TUBE
WOOD PLUG
3 1/2"
9 3/4"
1/4"
1/4" DISK PLASTIC VERMILLION
1/8" CUT ON MAIN 7/8" STANDARD
17 9/16
ALUMINUM OVERLAY
WOOD PLUGS
3/4" PLASTIC (ROD) VERMILLION
1/4" PLASTIC DISK ULTRAMARINE BLUE
1/16 ALUMINUM OVERLAY
GROOVE FOR CORD
7"
5/8"
3/8"
3/4"
1 1/8"
8 7/8"
11 1/8"
7/8
3/4"
1/4"
13/16
8 7/8"
9 3/4"
9"
7
11 1/8"
PLAN OF LAMP

④

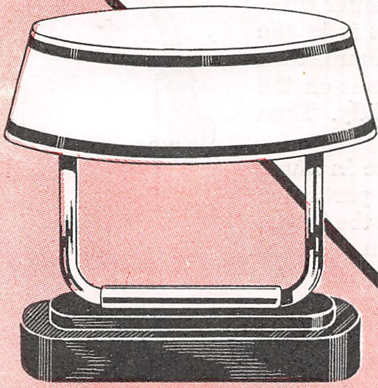


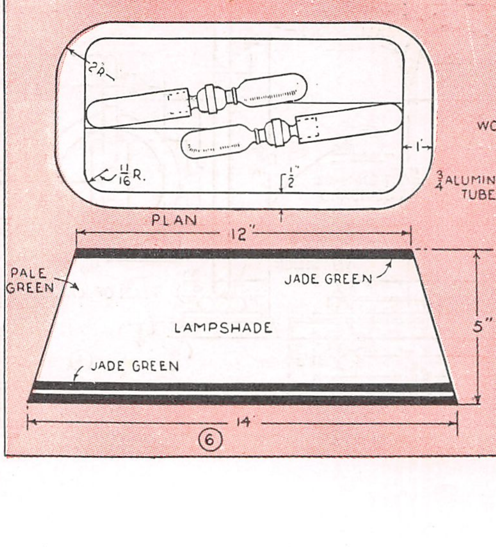
⑤

attaches to the base is cut squarely across to a depth of ⅛ in. This assures a firm bearing. As the upper section of the base is a disk of plastic, screws holding the ornamental rods are driven up from the underside, while those fastening the main and decorative tubes are driven down from the top. Don't forget the overlays and plugs in the exposed ends of the tubes. The procedure in finishing up both lamps is very much the same. Before assembly, the metal parts must be highly polished on a buffing wheel as in Fig. 2 and where Duralumin screws are used the heads must be filed flush. The ends of the aluminum rim can be soldered as in Fig. 5, but Duralumin screws are usually better. If carefully filed and polished, the exposed heads are not objectionable in this type of work.

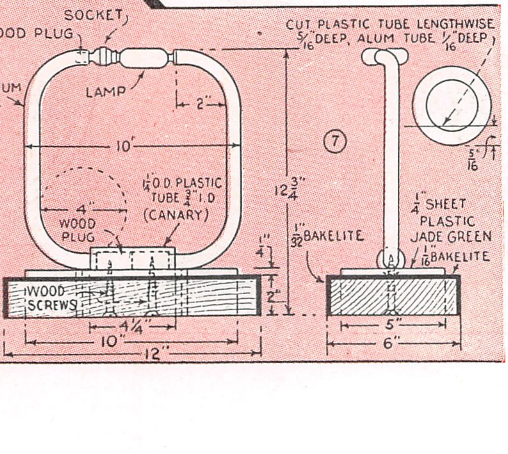
About the only comment to be made on the style detailed on Figs. 6 and 7 is that concerning the construction of the base. This is "veneered" with thin sheets of Bakelite and can be done easily by bandsawing the base to size from a piece of softwood, using the waste pieces as cauls when clamping the thin strips of Bakelite. Note in Fig. 7 that the uprights are bent separately and joined at the lower ends with a sleeve of plastic tubing flattened on one side to fit the upper section of the base. Fig. 6 suggests a color combination for the shade.

Another base of distinctively modern styling is detailed in Fig. 8 and pictured in the heading. In making the three columns of this lamp you can do either of two things: Make each column of aluminum and plastic



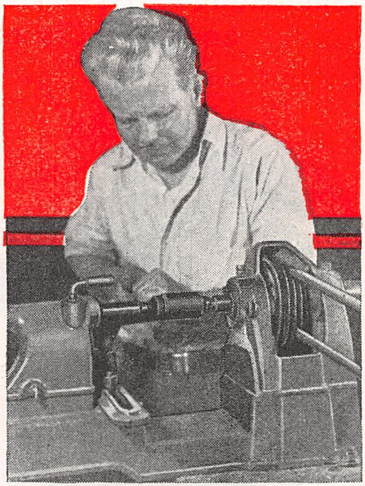

2 R.
11/16 R.
1"
1/2"
PLAN
12"
PALE GREEN
JADE GREEN
LAMPSHADE
5"
JADE GREEN
14"

⑥

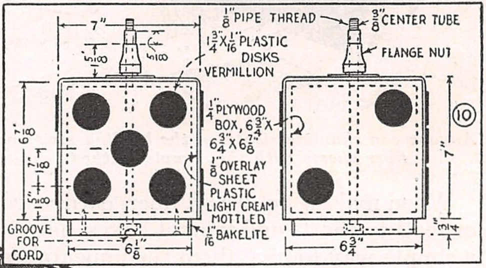

SOCKET
WOOD PLUG
3/4 ALUMINUM TUBE
LAMP
2"
10"
12 3/4"
1 1/4" O.D. PLASTIC TUBE 3/4" I.D. (CANARY)
4"
WOOD PLUG
1/4"
1/32" BAKELITE
2"
WOOD SCREWS
4 1/4"
10"
12"
CUT PLASTIC TUBE LENGTHWISE 5/16" DEEP, ALUM TUBE 1/16" DEEP
5/16"
1/4" SHEET PLASTIC JADE GREEN
1/16" BAKELITE
A
5"
6"

⑦

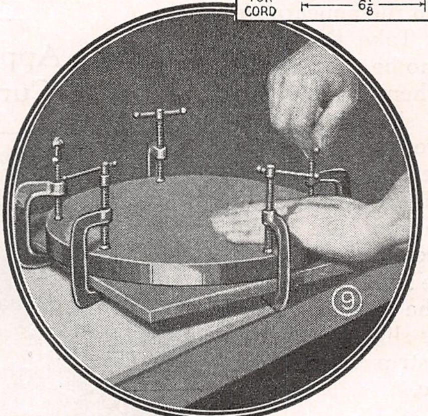
tubing of the same diameter, or the shorter aluminum tubes can be 1½ in. in diameter and the joining plastic tubes 1⅜ in. in diameter, leaving an offset as shown in the illustration. To do this you will have to turn a rabbet on the lower end of each of the plastic tubes so that the rabbeted end fits inside the larger metal tube. This construction will slightly alter the dimensions given in Fig. 8. Otherwise you make up the tubes in essentially the same way as the central column of the lamp base detailed in Fig. 1. The base is a two-part affair arranged as you see in the details, one section above the other, and, like those already described, is a Bakelite and aluminum "veneer" job.

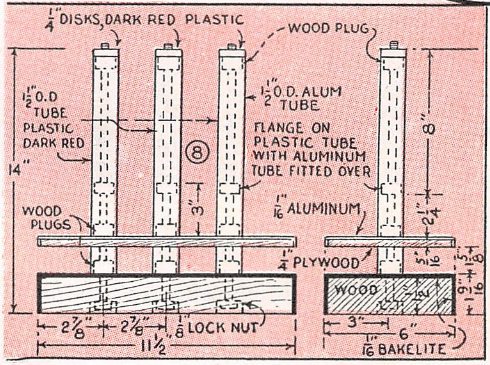


The "dice" lamp, an attractive novelty, turns up in Fig. 10. The base is simply a box made of ¼-in. plywood veneered with a sheet-plastic overlay. Then there is a sub-base as you will see, veneered with Bakelite and joined to the box with screws. The "spot" disks are cut from rod plastic, 1¾ in. in diameter, the disks being 1/16 in. thick with edges neatly rounded and the faces highly polished. These are fastened on with a special cement which you get from the manufacturer of the plastic. The details show how a center tube is fitted to carry the cord up to the light socket. The spot disk on the top is held in place by the flanged nut.

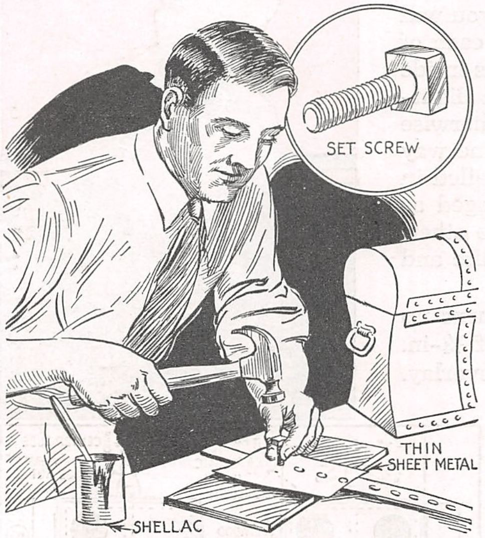

7"
5/8"
5/8"
1/8" PIPE THREAD
1 3/4" X 1/16" PLASTIC DISKS VERMILLION
3/8" CENTER TUBE
FLANGE NUT
1/4" PLYWOOD BOX, 6 3/4" X 6 3/4" X 6 7/8"
1/8" OVERLAY SHEET PLASTIC LIGHT CREAM MOTTLED
1/16" BAKELITE
6 7/8"
1 7/8"
1 5/8"
GROOVE FOR CORD
6 1/8"
6 3/4"
7"
3/4"
⑩

Now in all cases you have to provide a way to lead the light cord from the central column to the edge of the base. This is done by cutting a groove in the wood and carefully filing away the metal or Bakelite covering. With the cord in place and wired to the socket, the bottom of the base can be covered with a piece of green felt. On all these lamp bases, finish is the important thing. This means that all file and tool marks must be polished out on a buffing wheel. The polishing should be continued until you get a high gloss unbroken by even the slightest scratch or file mark. This often takes time. Where the plastic must be cut you will have a dull edge to polish back to the original luster. When you purchase the material it's a good idea to look it over carefully to see that there are no dents or deep scratches, which will be practically impossible to polish out to a smooth surface. When purchasing light sockets, be sure to get those with a ⅛-in. pipe thread.




1/4" DISKS, DARK RED PLASTIC
WOOD PLUG
1 1/2" O.D TUBE PLASTIC DARK RED
1 1/2" O.D. ALUM TUBE
FLANGE ON PLASTIC TUBE WITH ALUMINUM TUBE FITTED OVER
⑧
14"
8"
3"
2 1/4"
WOOD PLUGS
1/16" ALUMINUM
1/4" PLYWOOD
5/16"
1 5/8"
1 9/16"
1/2"
WOOD
2 7/8"
2 7/8"
1/8" LOCK NUT
11 1/2"
3"
6"
1/16" BAKELITE

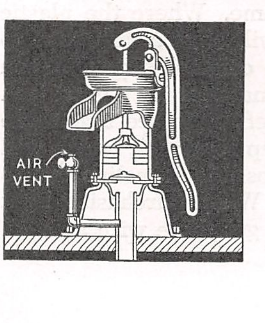
Simulating Rivets on Cardboard and Fiber Chests



Anyone can simulate rivets on the binding strips of fiber chests with this simple method

When making up wood, fiber, cardboard or leather chests and trinket boxes, here is a simple way to give them the appearance of having been riveted. Take the metal or leather binding strips to be used on the chest and lay one of them on a wood block. Then shellac one side of the material with which the rivets are to be imitated—thin sheet copper, brass, aluminum or heavy tinfoil—and lay it on top of the binding strip, shellacked side down. Now, take a new set screw that has a cupped end and form the rivets as shown. The set screw cuts out the imitation rivet head and sinks the edges slightly into the surface of the binding strip where it is held firmly by the shellac.

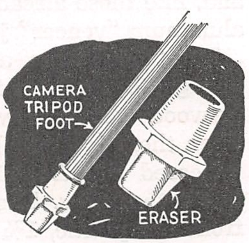
Pitcher Pump Kept from Freezing by Pet-Cock Air Vent



Pitcher pumps have the valves within them, and when these are in efficient operation, the water is held in the pump where it is apt to freeze. To avoid this, drill and tap one side of the pipe and insert a small nipple-and-elbow assembly, with a pet cock at the upper end. The cock should be left closed while the pump is in use, but, when left for any length of time, the pet cock should be opened so air will enter, and let the water recede to the cistern.

—G. E. Hendrickson, Argyle, Wis.

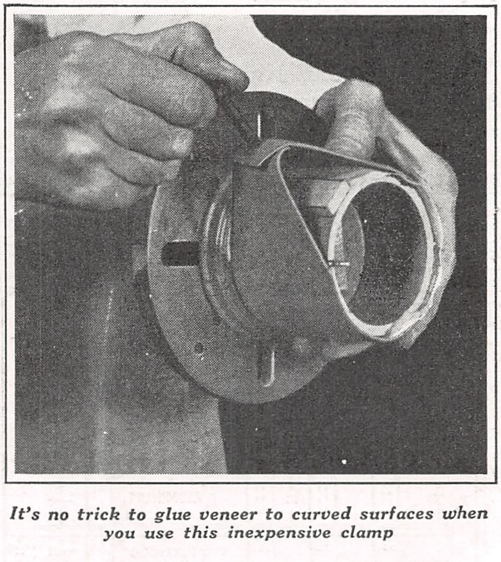
Tripod Fitted with Rubber Feet for Three Cents



Slipped over the points of a lightweight camera tripod, pencil erasers of the type shown provide efficient rubber feet for use on concrete, polished floors and other smooth surfaces. Also, the erasers afford excellent guards against tearing your clothes on the points when carrying or handling the tripod.

—Pat Fairmont, Cleveland, Ohio.

Clamp Applies Even Pressure to Curved Surfaces

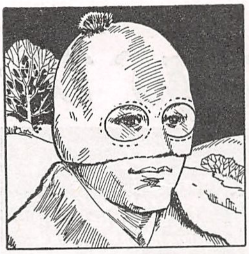


It's no trick to glue veneer to curved surfaces when you use this inexpensive clamp

A simple clamp for veneering or inlaying curved surfaces is made by using a piece of thin leather long enough to go around the work. Two holes in the ends of the leather take a bolt fitted with a nut. The end of the bolt bears against a wood block placed on the curved surface and, when turned, pulls up the nut, which tightens the leather around the work. It is best to put a piece of wax paper between the leather and the work so that if glue oozes out of the joints, it won't stick to the leather or wood.

—Thos. B. Owens, Cleveland, Ohio.

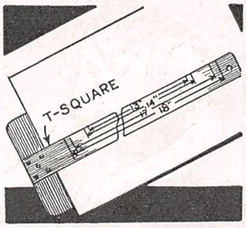
Stocking Cap with Goggles Shields Your Face



If you must be outside in extremely cold weather, when the face needs protection, a stocking cap fitted with goggles will offer warmth for the entire head. Get a pair of leather-framed goggles and cut down the frame so that they can be sewed in openings made in the front of the cap. When they are not needed, the goggles can be rolled back over your head.

—Opie Read, Jr., Chicago.

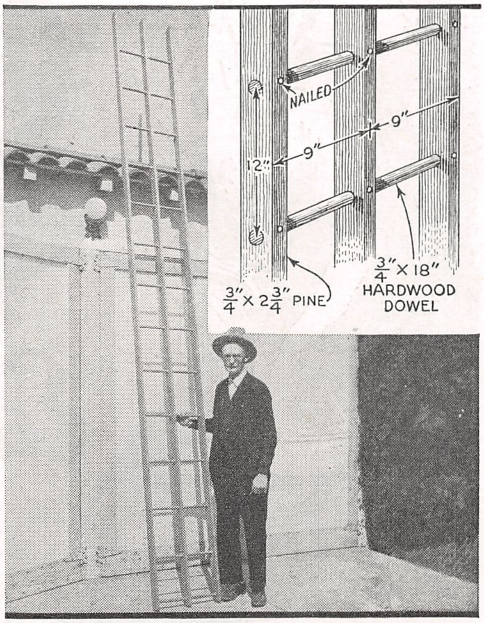
Dimensions Printed on T-Square Save Artist's Time



As most drawings are made to standard sizes, an artist can save considerable time in laying out the border lines by lettering the dimensions most often used, on his T-square as shown. As can be seen in the drawing, the lines have a common center point. While the ones given are for a finished sheet size of 14 by 18 in., any other dimensions can be used and, by making the lettering small, two or more sets of dimensions for various sheet sizes can be put on one T-square.

—Milton Tyler, Jr., Birmingham, Ala.

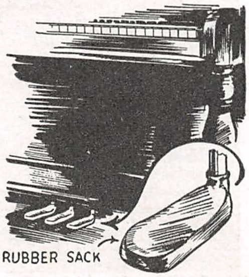
Lightweight Ladder of Pine Is Unusually Strong



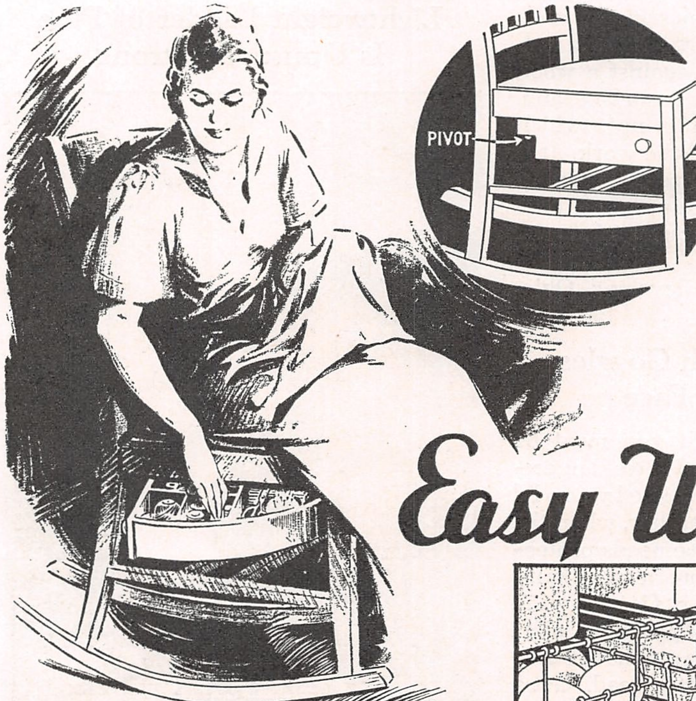
Three pine rails give this ladder unusual rigidity without making it excessively heavy

This 14-ft. ladder is much lighter than one of conventional construction, yet it is equally strong and rigid. Seven ¾-in. hardwood dowels, 3 ft. long, are cut in half for the rungs. The side and center members are temporarily nailed together while holes, spaced 1 ft. apart, are bored for the rungs.

Piano Pedals Fitted with Covers

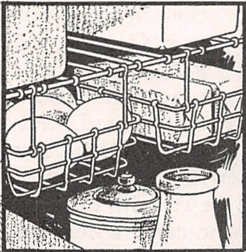


Piano-pedal covers are made easily from pieces of inner tube cut to shape and either sewed or cemented together. After sewing them, they are turned inside out and slipped over the pedals. Such covers offer a soft touch and, in cases where the pedals have been bent down slightly, they serve as cushions, thus eliminating noise, and preventing wear on the carpet or floor.



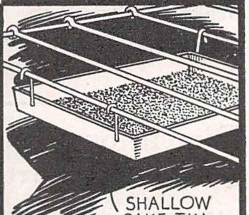
Adding a real convenience to the small sewing rocker, this shallow drawer pivots on one side rail of the chair The drawer has only three sides, one being curved to clear the front leg. Partitions inside enable a neat, orderly arrangement of your sewing equipment so that it is easy to find what you need. The front of the drawer may be rabbeted for a ¼-in. plywood bottom, the lower edge of the front projecting to serve as a grip if you wish to eliminate the drawer pull.

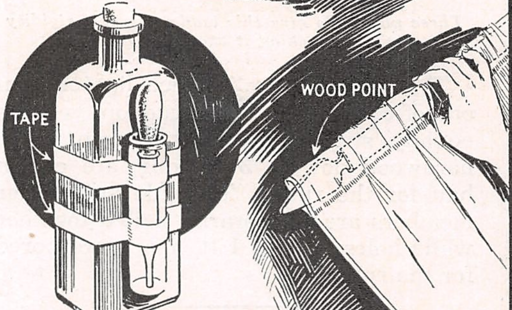
Easy Ways to



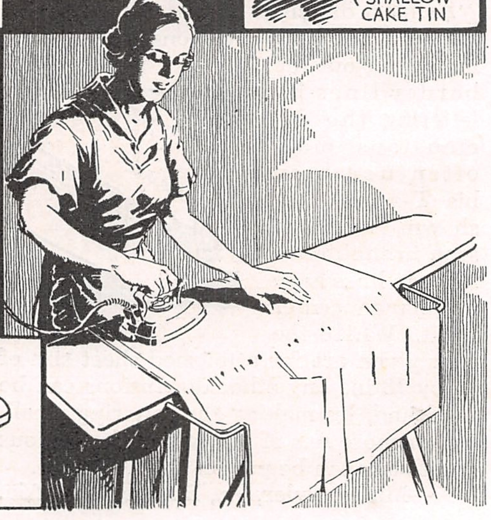
Unused space in your refrigerator can be utilized to advantage if you suspend wire soap dishes from the shelves to hold numerous small items such as eggs, etc.

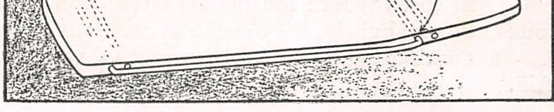
To absorb food odors in a refrigerator, spread pulverized charcoal in a shallow cake tin. Wire hooks permit hanging it on a shelf

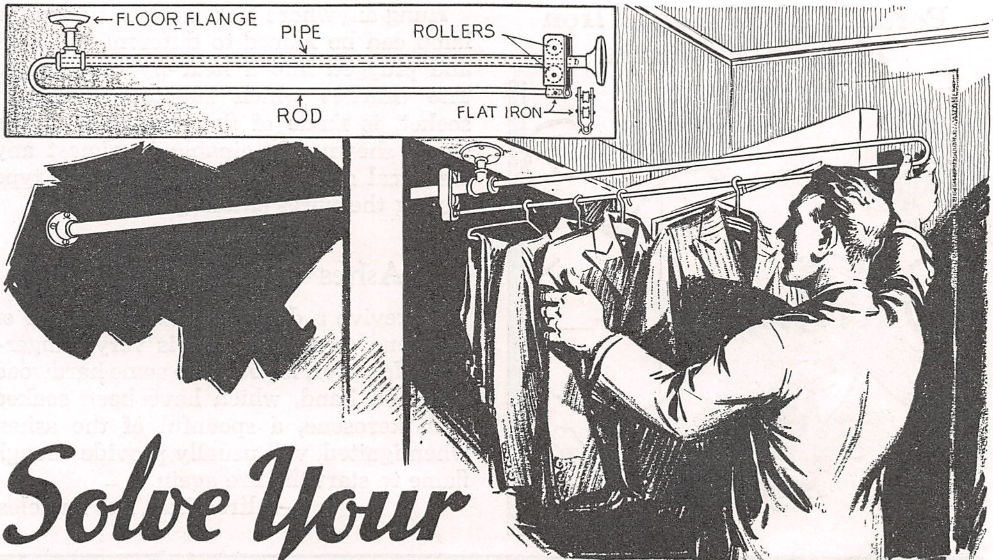




Where a medicine dropper may leave stains when laid down, a small bottle may be taped to the larger one to hold the dropper, as in the circular insert. Whittled to fit the end of a flat curtain rod, the wood point shown above makes it easy to push the rod through the hem without "catching." When ironing large pieces, which often required the use of chairs to keep the ironed portions off the floor, you will find the ironing-board "rails" on the right much more convenient for this purpose. They fit snugly against the edges of the board when not in use

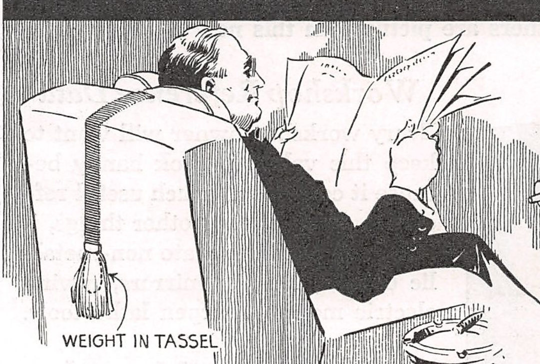


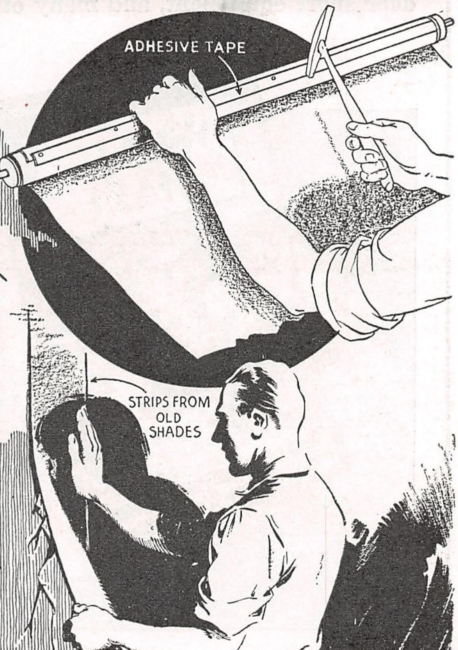

BRASS RODS FIT IN HOLES



Solve Your HOME PROBLEMS

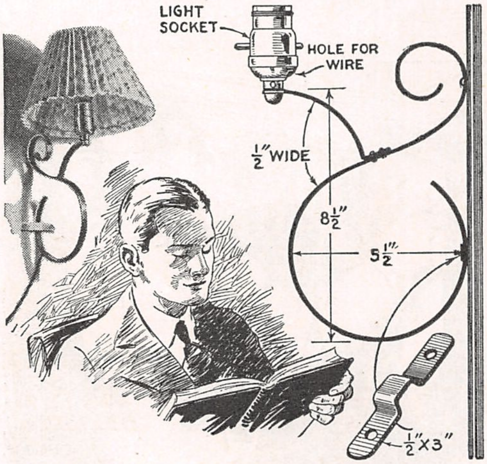
Above is a homemade extension clothes rack that fits snugly in a closet and can be pulled out into the room to provide easy access to the clothing. From the upper detail you will find how simple it is to make and install. The rod is bent to a narrow U-shape; one leg travels inside of the pipe, while the other leg is suspended below it, the end being attached to a roller that rides on the pipe. Pipe fittings hold the assembly to the closet wall and door frame





Counterweighted head cushion for an easy chair is quickly adjusted to suit the occupant and will "stay put." Wide braid is sewed to the cushion at one end while the other end is fitted with a tassel of corresponding material and color to completely conceal a small lead weight. If you have troubles with shades pulling away from the rollers, try using a strip of ordinary adhesive tape over the doubled edge of the shade and then drive in the tacks. And, if you have old shades, don't throw them away, but use strips of the material to paste over wall cracks before applying wall paper. You'll find that the paper won't tear again at these points

Portable Wall Lamp of Iron Plugs In Anywhere



Hung anywhere on a wall, this portable lamp can be moved to different locations and plugged into a near-by wall outlet. The bracket which supports the light socket, is made of flat iron bent to the shape shown. Obtainable in almost any electrical store, the socket is of the type having the wires entering at the side.

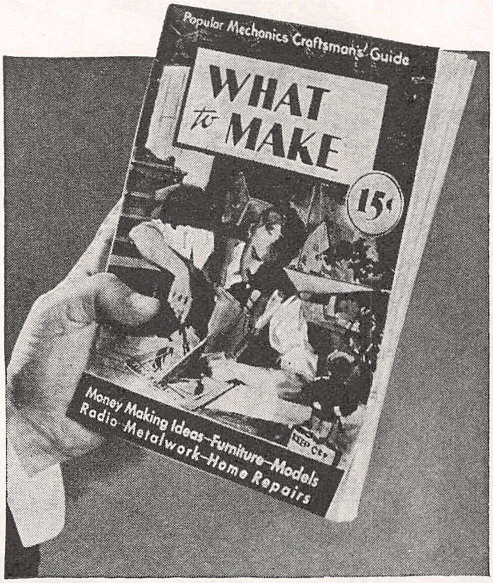
Ashes Used as Kindling

To revive a dying grate fire, the use of kerosene on the embers is very dangerous. However, if you keep some hardwood ashes on hand, which have been soaked with kerosene, a spoonful of the ashes, when ignited, will usually provide enough flame to start the fire again.

—Alfred Ball, Los Angeles.

What to Give This Christmas?

Something novel, something different, and something that you can't find in a store! Such distinctive gifts are produced right in your own home workshop, and are the kind your friends will really appreciate. You'll save money too, as the material costs much less than ready-made items. Hundreds of suggestions — smoking stands, bric-a-brac shelves, cedar chests, small tables, clocks, toys, models, outdoor sport equipment, and many others are pictured in this new 96-page book.


Popular Mechanics Craftsman's Guide
WHAT to MAKE
15¢
Money Making Ideas-Furniture-Models
Radio-Metalwork-Home Repairs

Workshop Reference Data

Every workshop owner will want to keep this valuable book handy because it contains so much useful reference data. Among other things, it tells how to electroplate non-metallic objects, resilver mirrors, rewind electric motors, sharpen lathe tools.

Where to Get Material

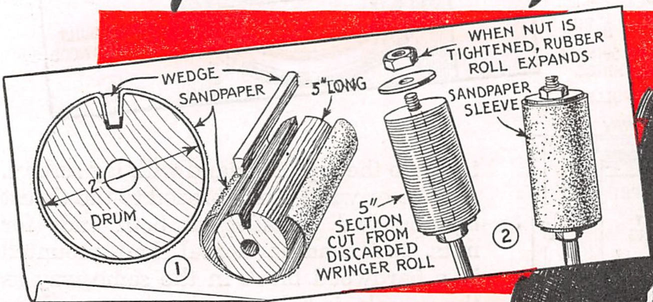
Besides, many manufacturers have listed their products in "What to Make," so that you will have little difficulty in knowing just where to purchase many "hard-to-get" materials and supplies.

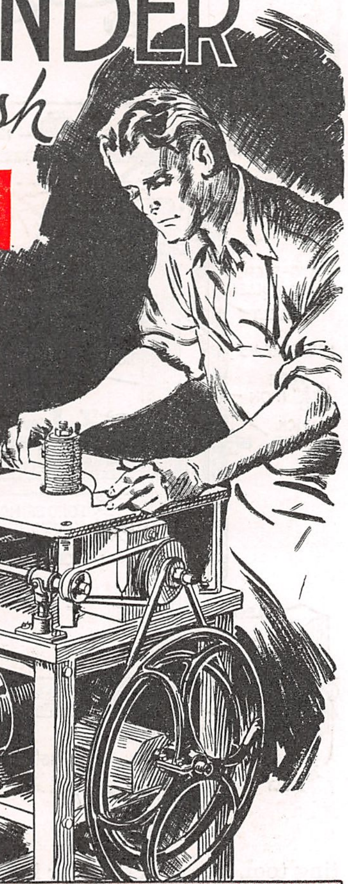
Just send 15c in stamps for your copy of the 1937 "What to Make" to

POPULAR MECHANICS MAGAZINE, Dept. O, 200 E. Ontario Street, Chicago

SHOP NOTES

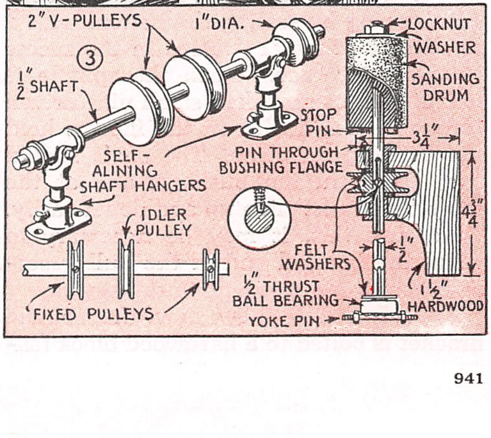
Oscillating SANDER gives smooth finish

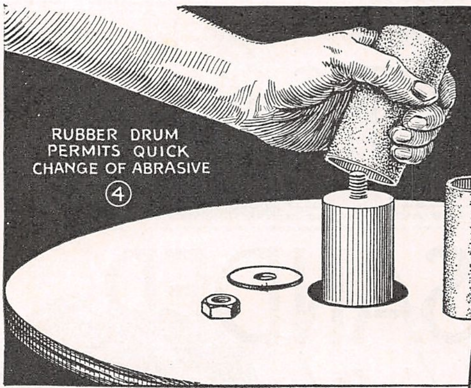

WEDGE
SANDPAPER
5" LONG
2"
DRUM
①
WHEN NUT IS TIGHTENED, RUBBER ROLL EXPANDS
SANDPAPER SLEEVE
5" SECTION CUT FROM DISCARDED WRINGER ROLL
②

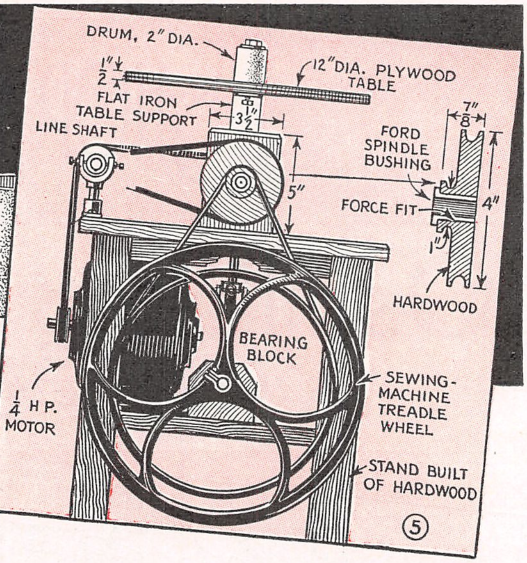


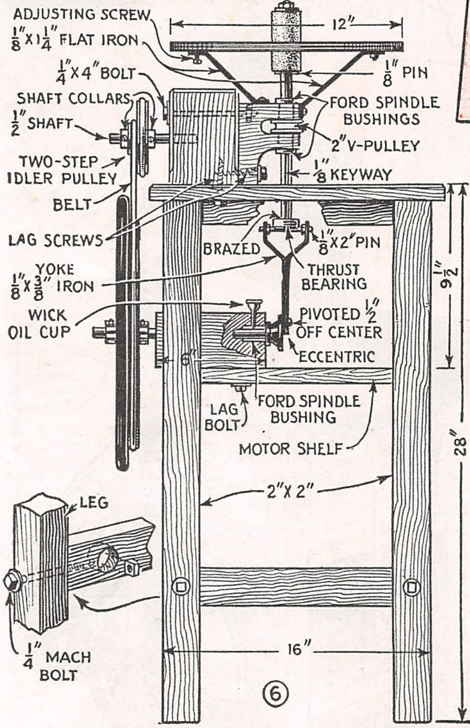
By Wayne C. Leckey

CUTTING on a radial spiral, due to its up-and-down movement, this efficient spindle sander leaves a smooth, clean finish on the edge of scrollwork. Oscillating motion of the drum prevents clogging the abrasive and distributes the wear over nearly the whole of the cutting area. Figs. 1 and 2 show methods of making the drum, which can be made from a wooden cylinder or, better still, a section of discarded wringer roll, as in Fig. 2. With the latter you can use ready-made abrasive sleeves. In either case, the spindle carrying the drum is a length of ½-in. steel shafting running in Ford spindle bushings reamed to fit and mounted in a hardwood bracket as in Fig. 3. A ball thrust bearing is brazed to the lower end of the shaft and a flared keyway is cut in the shaft to take the tapered end of the setscrew holding the drive pulley. The keyway can be cut in a metal-working lathe by mounting the shaft between centers and running the carriage by hand, taking off light cuts with a beveled cut-


③
2" V-PULLEYS
1" DIA.
1/2" SHAFT
SELF-ALINING SHAFT HANGERS
STOP PIN
IDLER PULLEY
FIXED PULLEYS
LOCKNUT
WASHER
SANDING DRUM
3 1/4"
PIN THROUGH BUSHING FLANGE
4 3/4"
1/2"
FELT WASHERS
1/2" THRUST BALL BEARING
1 1/2" HARDWOOD
YOKE PIN


RUBBER DRUM PERMITS QUICK CHANGE OF ABRASIVE ④

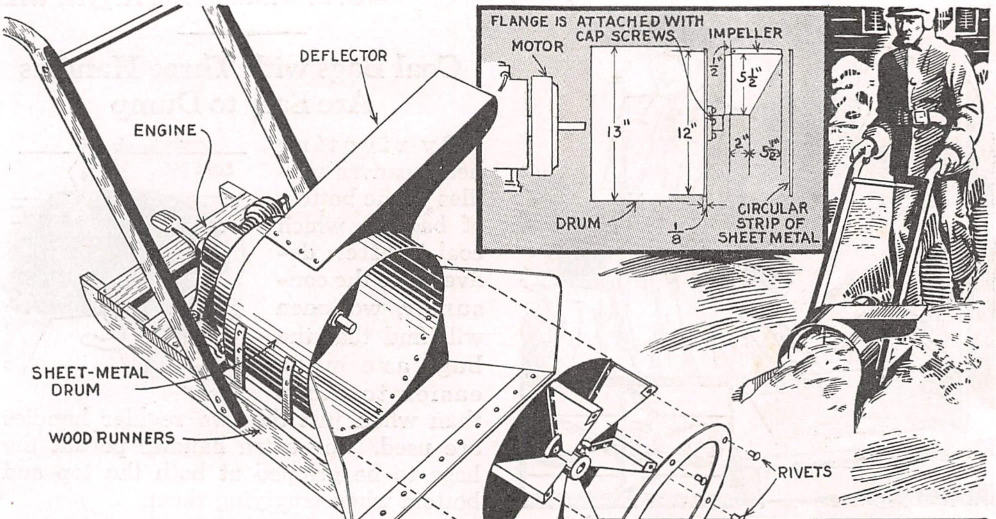

DRUM, 2" DIA.
1/2"
12" DIA. PLYWOOD TABLE
FLAT IRON TABLE SUPPORT
3 1/2"
1/8"
LINE SHAFT
7/8"
FORD SPINDLE BUSHING
5"
FORCE FIT
4"
1"
HARDWOOD
BEARING BLOCK
1/4 H.P. MOTOR
SEWING-MACHINE TREADLE WHEEL
STAND BUILT OF HARDWOOD
⑤

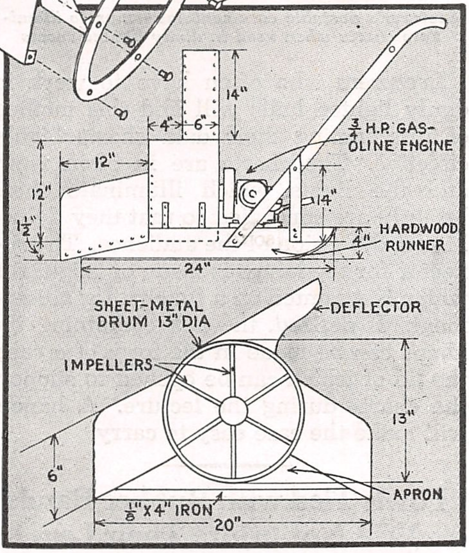

ADJUSTING SCREW
1/8" X 1 1/4" FLAT IRON
12"
1/4" X 4" BOLT
1/8" PIN
SHAFT COLLARS
FORD SPINDLE BUSHINGS
1/2" SHAFT
2" V-PULLEY
TWO-STEP IDLER PULLEY
1/8" KEYWAY
BELT
LAG SCREWS
BRAZED
1/8" X 2" PIN
1/8" X 3/8" YOKE IRON
THRUST BEARING
9 1/2"
WICK OIL CUP
PIVOTED 1/2" OFF CENTER
ECCENTRIC
6"
LAG BOLT
FORD SPINDLE BUSHING
MOTOR SHELF
28"
2" X 2"
LEG
1/4" MACH BOLT
16"
⑥

ting tool. An oil chamber is formed in the ball bearing by sealing the bottom with a small disk of metal pressed in the recess of the outer race. When the spindle is mounted in the bracket, small pins driven through holes drilled in the flanges hold the bushings in place. The shaft should turn freely in the bushings and at the same time must slide up and down easily. To assure this, it may be necessary to grind the beveled end of the pulley set-screw so it does not bind in the keyway.

Figs. 5 and 6 show how the spindle bracket is bolted to a hardwood block fastened to the top of a stand with lag screws. A yoke or wrist pin is brazed to the thrust bearing and threaded at both ends for nuts. A second horizontal shaft, mounted in a hardwood block in the same way as the spindle, is bolted to the motor shelf as in Figs. 5 and 6 and carries a sewing-machine treadle wheel, which is belted to a two-step idler pulley driven off the line shaft. This reduces the speed of the crank disk which imparts the up-and-down motion to the spindle through a connecting rod as in Fig. 6. The line shaft, made as in Fig. 3, carries two fixed V-pulleys and one idler, which is bronze-bushed, as it must turn in a direction opposite to that of the shaft. A ¼-hp. motor mounted on the shelf as in Fig. 5, drives the spindle through a round belt running over the line-shaft pulleys as shown. A steel pin passing through the spindle provides a support for the wooden drum. This pin is an easy fit so that it can be removed and the spindle taken out if necessary. The top end of the spindle is threaded for a nut and washer. To mount the rubber drum the spindle must be threaded back about 6 in. from the top end and the drum mounted as in Fig. 2. This construction permits a quick change of the abrasive sleeves as in Fig. 4. The stand which supports the spindle and drive mechanism can be made of hardwood. Exact dimensions are not important.

Rotary Plow Whirls Snow Away from Walk


DEFLECTOR
ENGINE
SHEET-METAL DRUM
WOOD RUNNERS
FLANGE IS ATTACHED WITH CAP SCREWS
MOTOR
IMPELLER
1/2"
5 1/2"
13"
12"
2"
5 1/2"
DRUM
1/8
CIRCULAR STRIP OF SHEET METAL
RIVETS


14"
4"
6"
3/4 H.P. GASOLINE ENGINE
12"
12"
1 1/2"
14"
4"
HARDWOOD RUNNER
24"
SHEET-METAL DRUM 13" DIA
DEFLECTOR
IMPELLERS
13"
6"
APRON
1/8"X4" IRON
20"

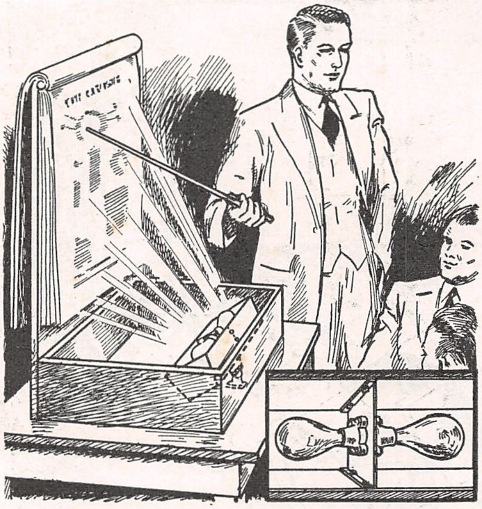
To take the toil out of snow shoveling, it's hard to beat this small rotary, motor-driven plow, which "eats" through heavy layers with speed and throws the snow several feet from the walk. It was found highly successful and is just the thing where large areas of snow-covered walks must be cleared in a short time. The plow is mounted on hardwood runners and consists of an impeller mounted on the engine shaft and enclosed in a sheet-metal housing. This is open at the front end, has a deflector riveted to the top side, and an apron extending out in front to scoop up the snow and direct it against the impeller. The latter is a disk of ⅛-in. metal with a flange in the center for attaching it to the motor shaft. Made of heavy sheet metal, the impeller blades are bent at right angles ¾ in. from rear edges so that they can be riveted to the disk. Also, the top and a short portion of the front edges are bent similarly to strengthen them and to permit a sheet-metal ring to be riveted to the front edge for further rigidity. The front edge of the apron is reinforced with a piece of flat iron, which is ground to serve as a scraper on the walk surface. Fitting the runners with two well-braced handles to enable one to push the plow conveniently, completes the job.

—Gaston R. Pichette, Lake Linden, Mich.

"Cellophane" Storm Sash for Baby's Sun Bath

When the weather becomes too cold to give the baby a sun bath outdoors, you can do so indoors if you substitute a Cellophane window for one of the regular storm windows. The idea is based on the fact that ultraviolet rays will pass through Cellophane but will not penetrate glass. So, a few minutes after raising the regular sash, you can place the baby in the full sunlight. The storm sash should be sealed tightly to prevent cold air from entering.

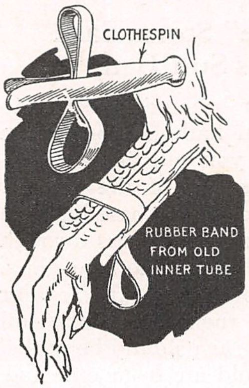
Brightly Illuminated Charts Aid Lecturer in Halls



Lecturer's portable case contains lamps to illuminate charts when used in dimly lighted rooms

Lecturers who often have to work in dimly lighted halls will find this method of illuminating their data charts highly effective. The charts are in plain view, and the lights which illuminate them brightly are concealed so that they do not hinder the vision of the audience. The reflector for the lamps is made of bright tin, which is mounted on a bracket for adjustment. If desired, the box containing the lamps can be made in the form of a case, the lid of which can be opened to support the charts during the lecture. A handle will make the case easy to carry.

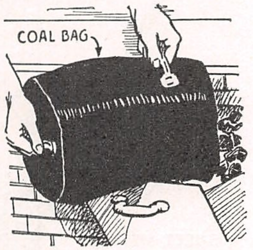
Fowls Tied with Rubber Bands Will Not Injure Their Legs


CLOTHESPIN
RUBBER BAND FROM OLD INNER TUBE

Instead of tying the legs of fowls with twine, it is better to cut bands from an old inner tube and fit one of these around both legs of each bird, slipping a clothespin over the doubled band and drawing the loop up snugly as shown. The bands hold the legs tightly, yet do not injure them when the fowls struggle.

—G. E. Hendrickson, Argyle, Wis.

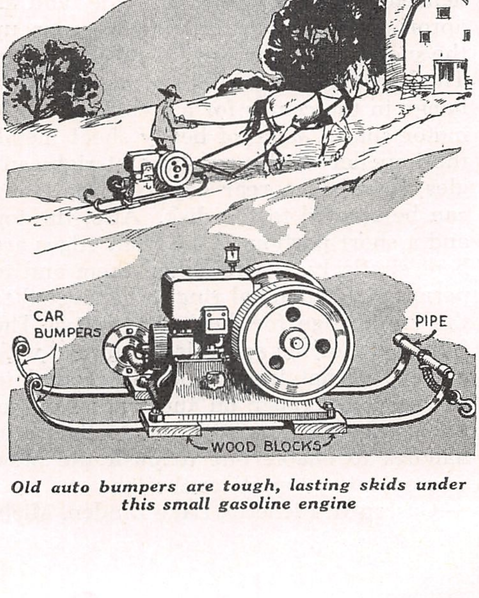
Coal Bags with Three Handles Are Easy to Dump



By riveting heavy canvas handles to the bottom of bags in which coal is often delivered to the consumer, workmen will find that the bags are much easier to dump than when just the two regular handles are used. The extra handles permit the bags to be gripped at both the top and bottom when emptying them.

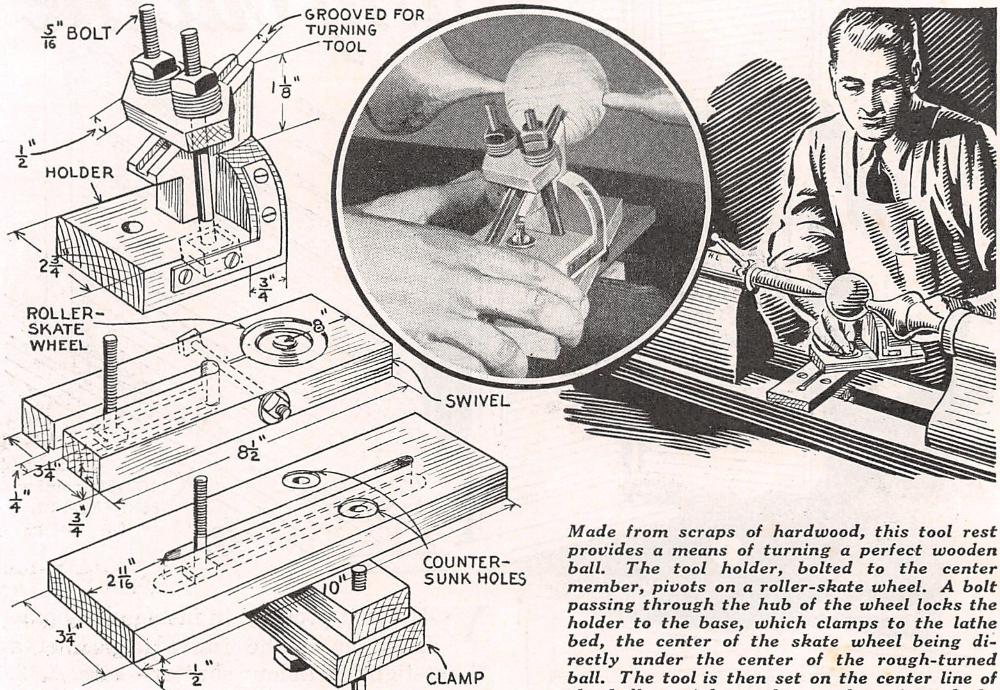
Strong Skids for Gas Engine from Auto Bumpers

On his farm where a small gas engine had to be moved to different jobs, and it was inconvenient to mount it on wheels, one farmer set it on skids, which were two discarded auto-bumper bars. Wooden blocks were interposed to elevate the engine to the desired height, the anchoring bolts being inserted up through the holes already provided in the bumpers.



Old auto bumpers are tough, lasting skids under this small gasoline engine

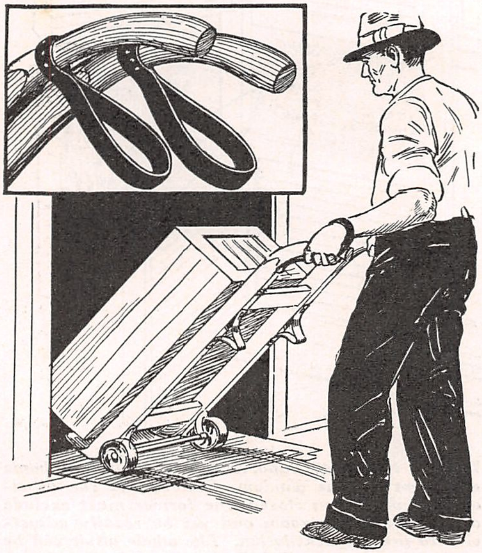
Swivel Tool Rest for Turning Wood Balls



Made from scraps of hardwood, this tool rest provides a means of turning a perfect wooden ball. The tool holder, bolted to the center member, pivots on a roller-skate wheel. A bolt passing through the hub of the wheel locks the holder to the base, which clamps to the lathe bed, the center of the skate wheel being directly under the center of the rough-turned ball. The tool is then set on the center line of the ball at right angles to the axis and the cuts are made 90 degrees, right and left

Heavy Hand Trucks Fitted with Pull Straps Easy to Move

To reduce tiresome strain on the hands, when gripping a heavily loaded hand truck to back it, attach a couple of leather straps to the handles as shown, so that they can be slipped over your wrists. With this arrangement, most of the pull comes on the wrists, making it unnecessary to grip the handles tightly. The straps can be attached with small brass screws, the heads of which should be sunk well into the surface of the leather to avoid tearing the clothing or injuring the hands on them.

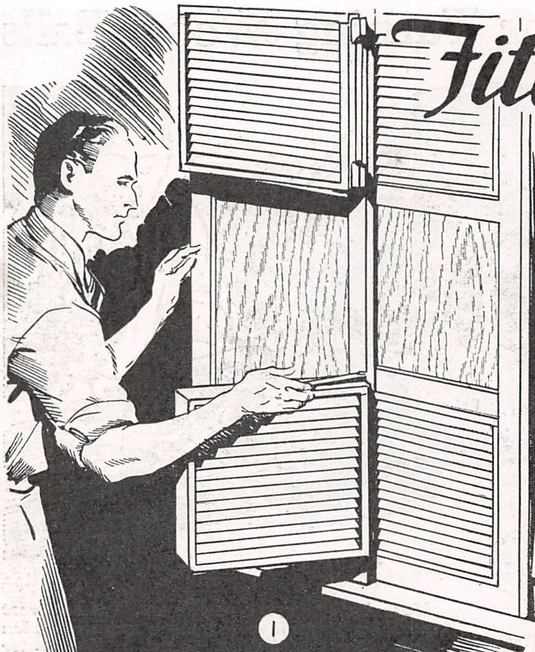


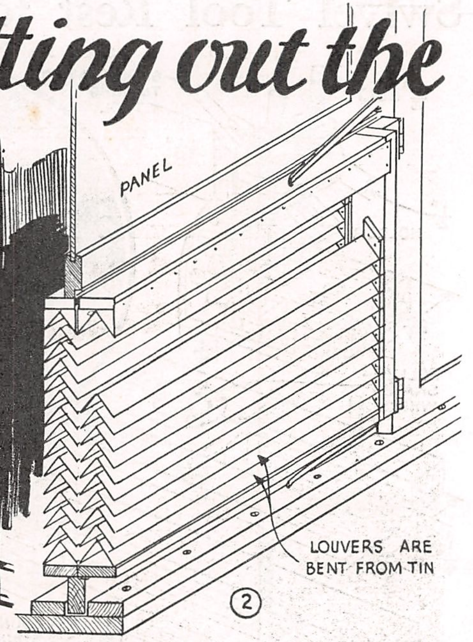
When these straps are slipped over the wrists, you can back a heavily loaded hand truck without gripping the handles tightly

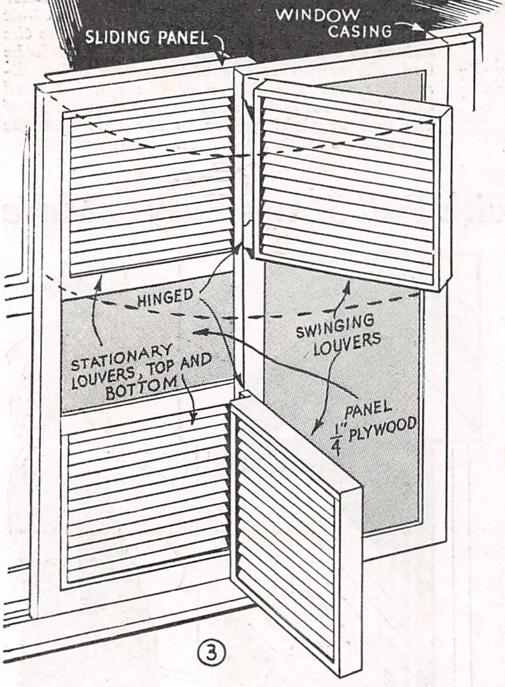
Alloy Tips Improve Lathe Centers

By welding tips of alloy of cobalt, chromium and tungsten to their tool-steel lathe and grinder centers, workmen in a Detroit plant, where crankshafts were machined and ground, increased the life of the centers from 1½ to 9 days. Also, it was found that the centers could be used indefinitely by simply renewing the tips.

Fitting out the



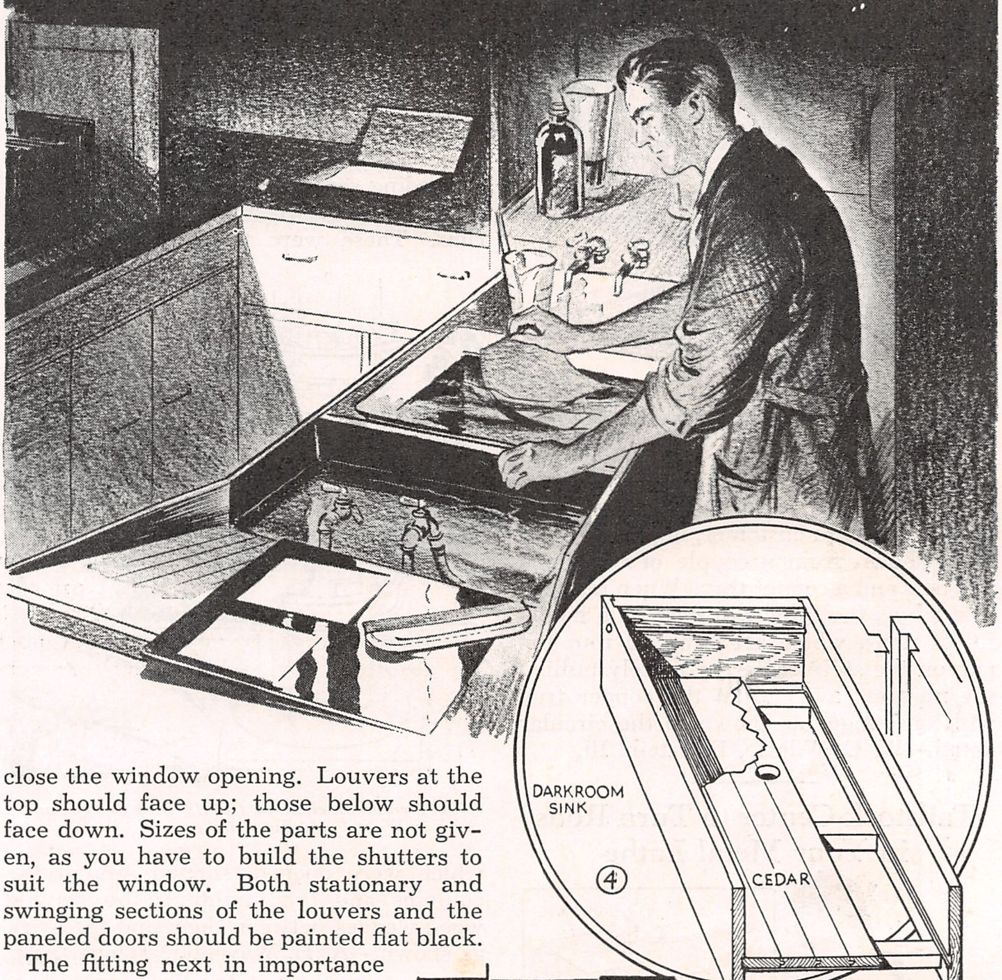




Two of the most important fittings in the home darkroom are the window shutters and the developing sink. When closed, the former must exclude all light from the room and yet be readily adjustable to provide ventilation. The whole affair can be made from two panel doors which slide in a frame built on the window casing. Two sets of louvers are attached to each door, one set stationary, the other hinged to swing open

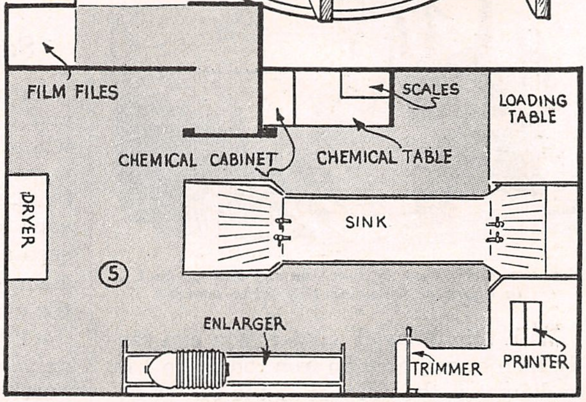
YOUR first problem in fitting up a home darkroom is the installation of a "light-tight" window shutter. Figs. 1, 2, and 3 show a way to do this without much trouble and expense. In this case the shutters are simply two sliding panel doors of a size to cover the window opening completely. These slide in a frame built out from the casing, the action being the same as that of showcase doors. Two sets of louvers are framed into the panel of the door next the window, as in Figs. 2 and 3. The louvers are installed in a frame and consist of a number of strips of heavy tin bent to a right angle along the length and set in an inverted position. The blocks, nailed at the ends of the frame, space these about ½ in. apart. A second set of louvers made in the same way and mounted in frames of identical size, is hinged to the inner door, the hinges being blocked out from the stile so that the frames swing flush as in Fig. 2. Care must be taken to see that these parts close tight to shut out all light from the window. When the doors overlap there will be an offset, of course, due to the separate grooves in which they slide. This can be effectively closed by two narrow strips, one on each stile, and so placed that they meet when the doors are slid apart to

HOME DARKROOM

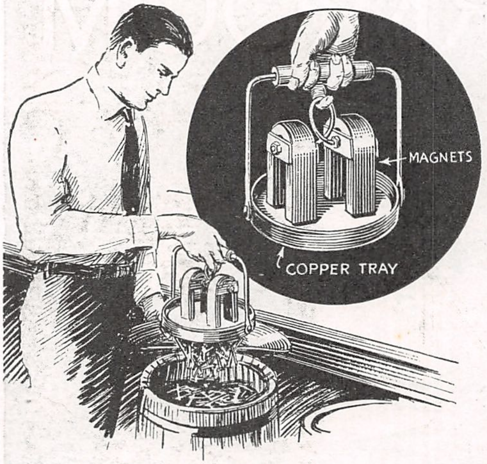

DARKROOM SINK
CEDAR
④

close the window opening. Louvers at the top should face up; those below should face down. Sizes of the parts are not given, as you have to build the shutters to suit the window. Both stationary and swinging sections of the louvers and the paneled doors should be painted flat black.

The fitting next in importance is the sink, and particularly its location. If the room is 8 by 10 ft. or larger, many photographers find it convenient to place the sink near the center of the room, with the film equipment on one side and the printing and enlarging apparatus on the other, as shown in the plan, Fig. 5. Fig. 4 shows the construction of the sink, which is built of cedar, impregnated on the inside with melted paraffin, and fitted with the usual drain and faucets to provide running water.


FILM FILES
SCALES
LOADING TABLE
CHEMICAL CABINET
CHEMICAL TABLE
DRYER
SINK
⑤
ENLARGER
TRIMMER
PRINTER

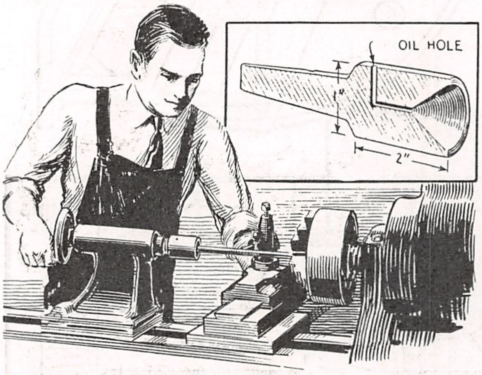
Merchant Takes Nails from Keg with Magnetic Lifter



Why scratch your fingers in removing nails from a keg when this simple lifter will do the job quickly?

One merchant who disliked scratching his hands when removing a few nails from a keg for a customer, improvised the lifter shown from a couple of telephone magnets and a copper tray. When inserted into a keg, the lifter will pick up a handful of nails, which are dropped into the pan on the store scales by merely pulling the magnets away from the copper tray with one finger as shown in the circular detail.—W. C. Wilhite, Edelstein, Ill.

Tailstock Center to Turn Rods in Your Metal Lathe



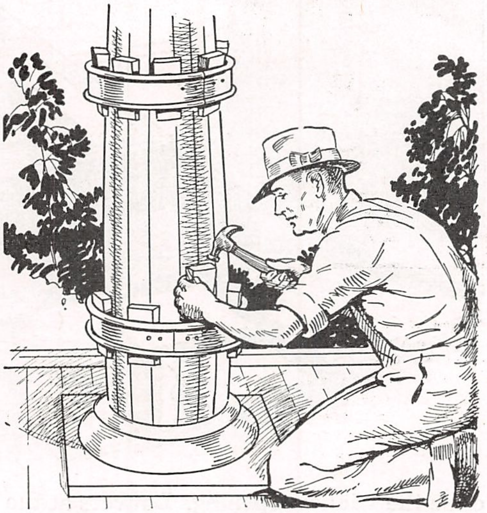
You can easily turn or machine any rod up to 1 in. in diameter by using this lathe center

With this tailstock center, you can easily turn or machine an iron rod up to 1 in. in diameter, the purpose of the center being to support the outboard end of the chucked work. The shank of the center is turned to the same taper as your regular lathe centers, and the large hole in the end is bored at a taper of 57°, the oil hole being made with a $\frac{5}{32}$-in. drill.

—Marquis Brown, Drexel, Mo.

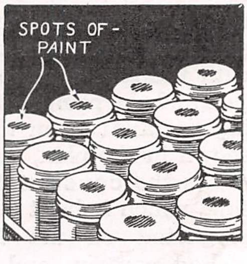
Column Clamps from Tire Rims Serve in Emergency

Needing some column clamps, one carpenter improvised them from auto-tire rims. These were the collapsible type, which were opened, slipped around the columns and then tightened by driving wood wedges between them and the work as shown.—A. H. Waychoff, Tempe, Ariz.



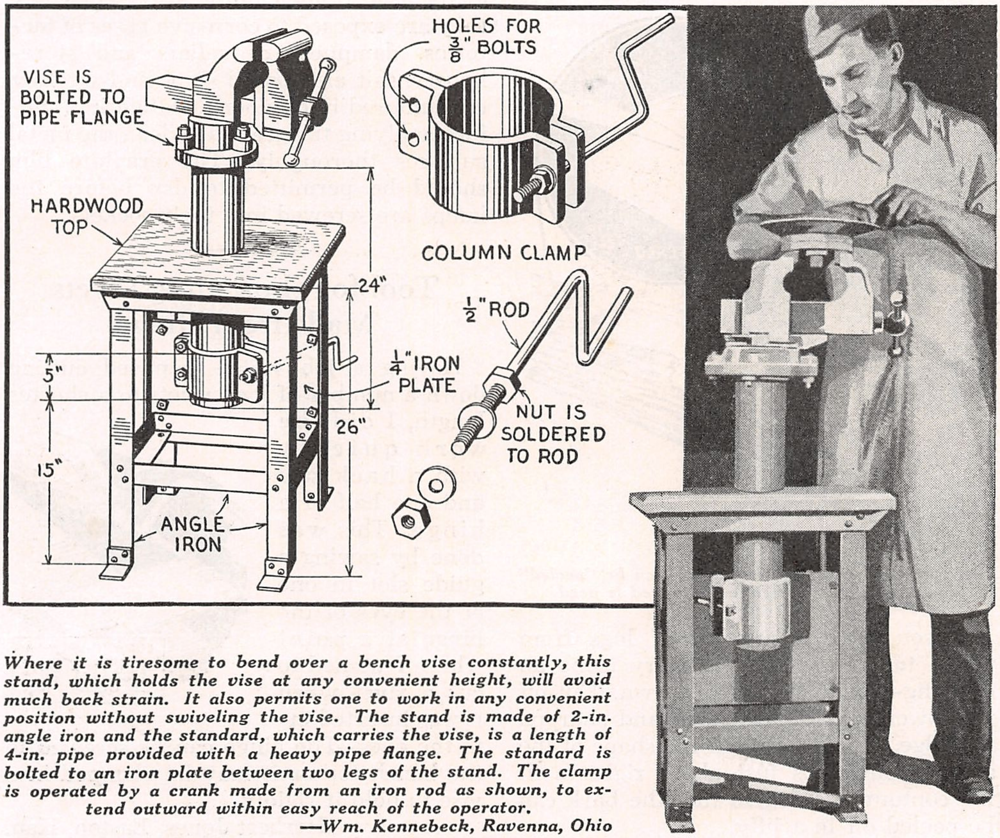
Wood columns clamped tightly with wedges and old auto-tire rims

Sample of Paint Put on Can



In art studios and other places where supplies of paints are kept on hand, the color in each can may be seen at a glance if a small daub of the paint is put on the lid. This takes only a few minutes when the paints are purchased and will save time later.

Vise on Portable Stand Adjusted for Height

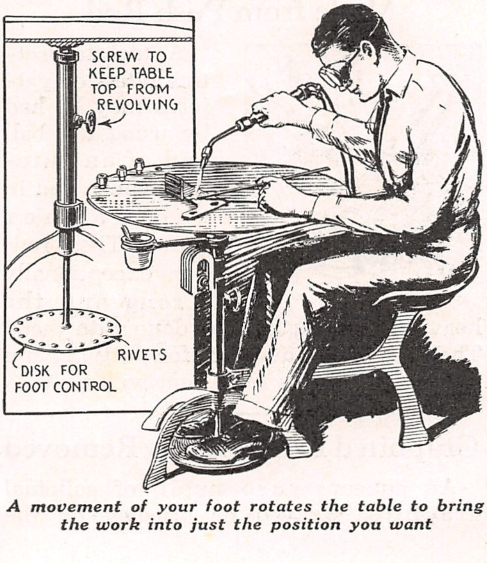

VISE IS BOLTED TO PIPE FLANGE
HARDWOOD TOP
HOLES FOR 3/8" BOLTS
COLUMN CLAMP
24"
1/2" ROD
5"
1/4" IRON PLATE
NUT IS SOLDERED TO ROD
26"
15"
ANGLE IRON

Where it is tiresome to bend over a bench vise constantly, this stand, which holds the vise at any convenient height, will avoid much back strain. It also permits one to work in any convenient position without swiveling the vise. The stand is made of 2-in. angle iron and the standard, which carries the vise, is a length of 4-in. pipe provided with a heavy pipe flange. The standard is bolted to an iron plate between two legs of the stand. The clamp is operated by a crank made from an iron rod as shown, to extend outward within easy reach of the operator.
—Wm. Kennebeck, Ravenna, Ohio

Welding Table Has a Rotating Top Controlled by Foot

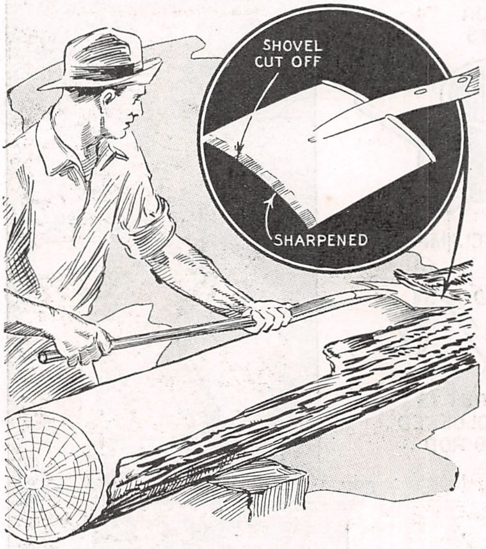
Made from parts available in most shops, this welding table has a rotating top, which is turned by foot, allowing the work to be moved in any position. It has a seat, swinging flux container, openings in the top to hold tools and a magneto to ignite the torch. A hand screw on the table tightens the standard to keep it from revolving and also allows the top to be raised for light work. Both the table top and a metal disk, by which the top is turned, are welded to a shaft. This works in the pipe standard, which has suitable legs welded to the lower end. Design of the table and the method of attaching the seat can be changed, of course, to suit the parts at hand. A thick asbestos pad keeps the table top from getting hot.

—Elmer A. Vandrey, Truman, Minn.


SCREW TO KEEP TABLE TOP FROM REVOLVING
RIVETS
DISK FOR FOOT CONTROL

A movement of your foot rotates the table to bring the work into just the position you want

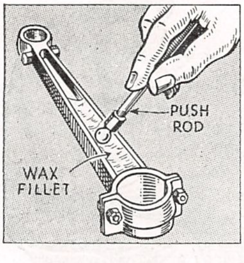
Bark Peeled from Logs Quickly with an Old Shovel



You'll be surprised how easy a log can be "peeled" if a shovel with the edge sharpened is used

If you have a number of logs from which to remove the bark, try using an old long-handle shovel as shown. Cut off the lower part of the blade and sharpen the edge. You'll find that the shape of the average shovel is just about right to fit the contour of a log so that the bark can be peeled off in a jiffy.

Handy Tool to Form Fillets Made from Push Rod

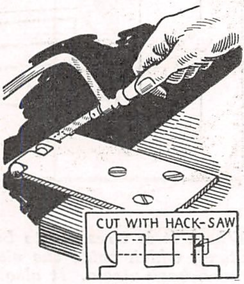


A tool for setting fillets on patterns may be had by using the ball end of an auto-valve push rod in the manner shown. These rods are exceptionally strong and the heaviest of work may be done with them. They are also convenient for puttying and calking in corners for a concave finish.

Graphited Lamps Easily Removed

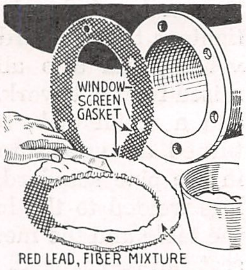
An aqueous suspension of colloidal graphite, sprayed or brushed on the threaded base of an electric bulb, will make it easy to remove. This idea is especially useful when bulbs are used where they are exposed to corrosive gases of factories, dampness of cellars and storehouses, salt air aboard ships and weather encountered in outdoor floodlighting. Before applying the graphite, clean the metal surfaces thoroughly. The graphite film should be permitted to dry before the lamps are screwed into their sockets.

Tool for Shortening Rivets Made from Hinge



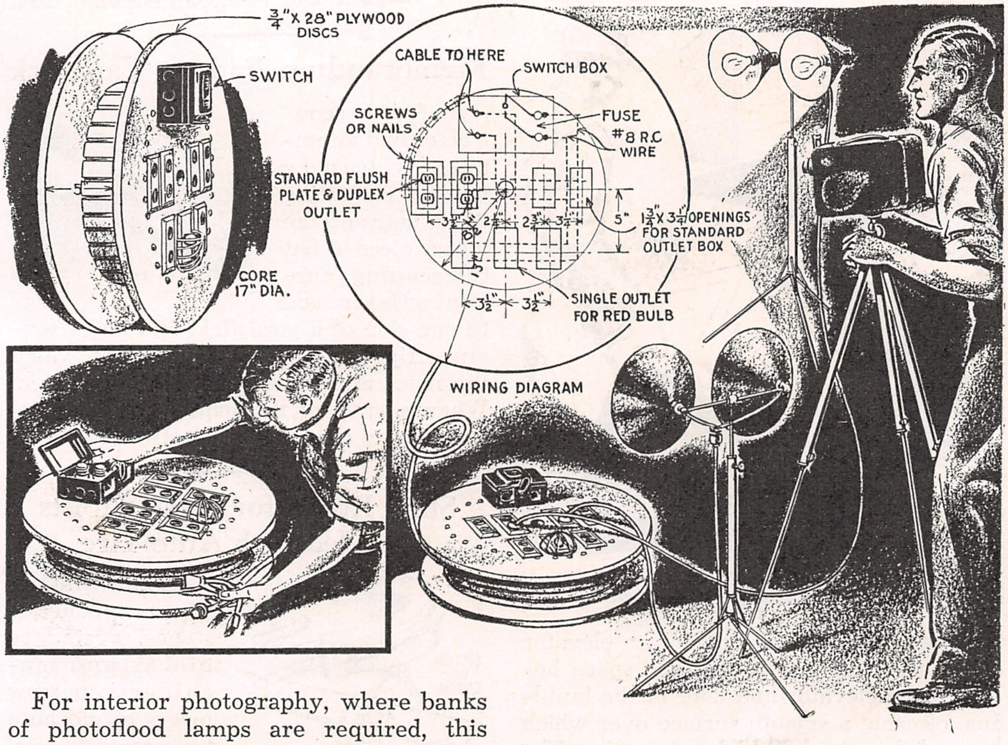
Having a job which required cutting down a number of long rivets to a shorter length, I did the work quickly with a hack saw and one half of a hinge. This was done by sawing a guide slot in one of the eyes of the hinge at a point where I wished to cut a rivet when it was inserted into the eyes. The hinge can be screwed to the bench top or it may be clamped in a vise to hold it rigidly.
—Herbert Jones, Easton, Kan.

Rough Flange Pipe Joints Sealed with Screen-Wire Gaskets



On a sewer job where the flange faces of the soil pipes had not been machined, and it was impossible to seal the joints with regular gaskets, substitutes of screen wire were used successfully. Two gaskets, with a 3/16-in. layer of red-lead mixture between them, were used at each joint. The mixture was made of oil and lead in the regular way, after which enough asbestos fiber was stirred in to produce a stiff putty.—A. H. Waychoff, Tempe, Ariz.

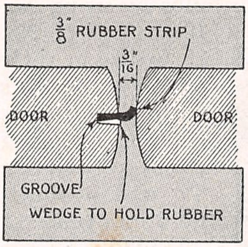
Many Lampcords Connect to Outlet Unit


3/4" X 28" PLYWOOD DISCS
SWITCH
5"
CORE 17" DIA.
CABLE TO HERE
SWITCH BOX
SCREWS OR NAILS
FUSE
#8 R.C WIRE
STANDARD FLUSH PLATE & DUPLEX OUTLET
3 1/4"
2 1/2"
2 3/4"
3 1/4"
5"
1 3/4" X 3 1/4" OPENINGS FOR STANDARD OUTLET BOX
3 1/2"
3 1/2"
SINGLE OUTLET FOR RED BULB
WIRING DIAGRAM

For interior photography, where banks of photoflood lamps are required, this multiple outlet unit and cable drum eliminates the need of numerous extensions to various wall outlets. Besides, where heavy loads are placed on the house circuit, especially when other electrical appliances are operating, this cable, fastened directly to the main line at the meter, permits maximum illumination without a "dropping off" in voltage. One long cable connects the main line to the drum, which is provided with a cutout box containing a d.p.s.t switch and two 30-amp fuses, a pilot light of low wattage to indicate whether current is available, and a number of duplex outlets, the latter being installed in switch boxes sunk flush with the surface of one side of the drum. The sides of the drum are ¾-in. plywood, 26 in. in diameter. All the wiring is finished before the core of the drum is installed. This consists of a number of small blocks set end to end between the sides and held in place by means of screws driven in from the outside. The size of the core will depend on the amount of cable used. In this case, the core diameter was 17 in. and a 75-ft. length of No. 8 flexible rubber-covered cable was used. The entire length of cable should be unwound from the drum and laid out full length before the extensions are connected on account of impedance caused by current passing through the coil.

—O. I. Sprungman, Minneapolis, Minn.

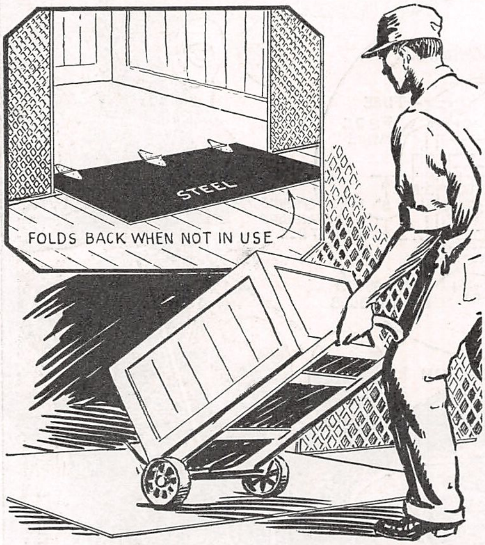
Double-Action Store Doors Easily Weatherstripped


3/8" RUBBER STRIP
3/16"
DOOR
DOOR
GROOVE
WEDGE TO HOLD RUBBER

In stores and other places where double-action doors are used, much of the cold air that passes between them can be kept out by a rubber strip as shown. Just take down one of the doors and plow a ⅛ by ¼-in. groove along the edge to take the rubber, which can be held in place with a thin, wedge-shaped strip.

—Lawrence Johnson, Spokane, Wash.

"Gangplank" on Freight Elevator Aids in Moving Hand Trucks

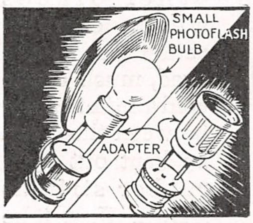

STEEL
FOLDS BACK WHEN NOT IN USE

Steel plate serves as "bridge" between elevator and floor over which to push hand trucks

Hinged to the front edge of an elevator floor, a steel plate bridges the space between the elevator and floor of the building, offering a smooth surface over which to push heavily loaded hand trucks. The steel plate, which folds back on the elevator floor when not in use, not only eases the workmen's job of pushing trucks, but makes it unnecessary to have the elevator absolutely flush with the floor.

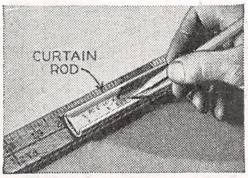
Using Small Photoflash Bulbs in Large Reflectors

Some photographers effect a saving in the cost of photoflash bulbs by using No. 10 instead of No. 20 bulbs in their synchronous flashlight outfits when taking close-up photos. To use a small bulb in a reflector intended for large ones, however, it is necessary to raise the bulb sufficiently with an adapter to place the light in the center of the reflector. The simple adapter shown, which raises the smaller bulb approximately 2½ in., can be assembled from parts obtained in a dime store.



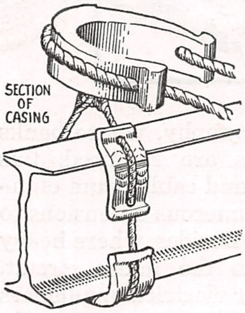
—E. R. Bogusch, San Antonio, Tex.

Memorandum Pad on Yardstick



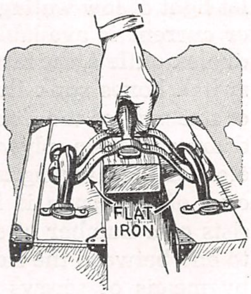
An Arizona contractor had an unusually handy method of jotting down notes on the job. A piece of flat telescoping curtain rod is screwed to one side of a yardstick, and holds several strips of heavy white paper on which the notes and measurements are written. When a strip of the paper is filled, it is removed to expose a clean strip.

Sling Ropes for Large Hoists Padded with Auto Tire



When hoisting steel beams, heavy stones, concrete blocks and machinery, narrow pieces of old auto tires provide good pads to keep sharp edges of the work from chafing the rope slings. Holes are punched in the ends of the pads and the ropes are threaded through them as indicated.

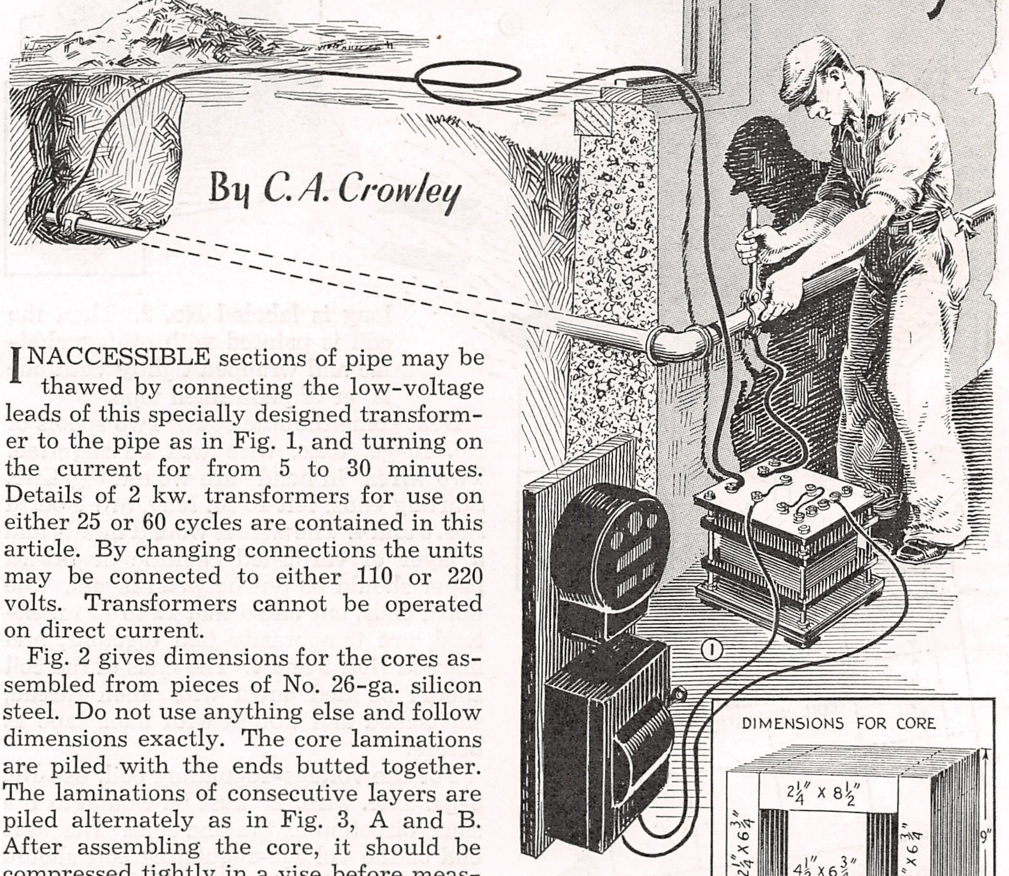
Suitcases Are Carried Easily with Portable Handles



Baggage boys and others who have to carry luggage will find it an easy matter to carry two bags or suitcases in each hand with this handle. It is simply a wood block fitted with a leather grip and two flat-iron hooks from which the suitcases are suspended as shown.

FROZEN WATER PIPES
thawed with electricity

By C. A. Crowley

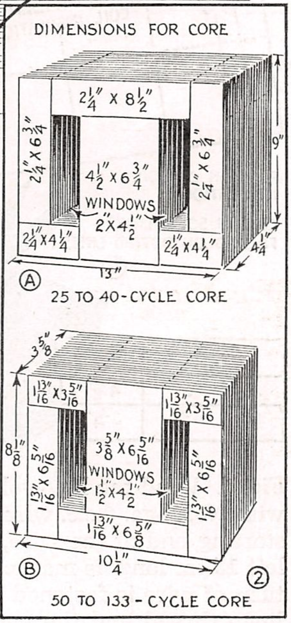


INACCESSIBLE sections of pipe may be thawed by connecting the low-voltage leads of this specially designed transformer to the pipe as in Fig. 1, and turning on the current for from 5 to 30 minutes. Details of 2 kw. transformers for use on either 25 or 60 cycles are contained in this article. By changing connections the units may be connected to either 110 or 220 volts. Transformers cannot be operated on direct current.

Fig. 2 gives dimensions for the cores assembled from pieces of No. 26-ga. silicon steel. Do not use anything else and follow dimensions exactly. The core laminations are piled with the ends butted together. The laminations of consecutive layers are piled alternately as in Fig. 3, A and B. After assembling the core, it should be compressed tightly in a vise before measuring the thickness. Values given for the thickness of the core apply to the compressed thickness. Many transformers draw excessive current because their cores were not compressed tightly enough. After assembly and while the core is held in the vise, the three "legs" should be taped together tightly. One layer of tape wound half-lap around each of the three legs is sufficient—no more.

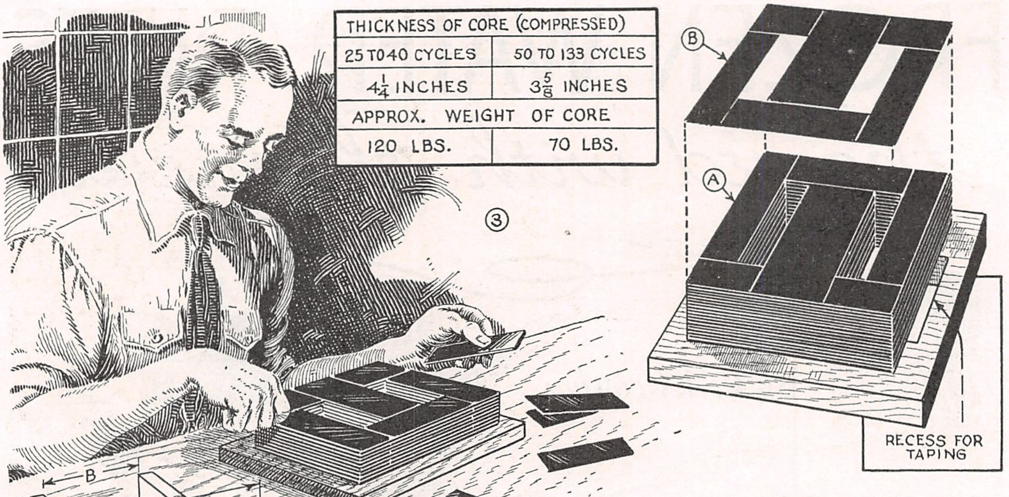
A hardwood form, Fig. 4, is used to wind the coils. For size, see the table. Wood screws hold the stationary and sliding end pieces in place. The form should be finished smooth so coils can be removed readily. Before winding, a sheet of fiber, detailed in Fig. 5, is placed on the form. Where the fiber is bent, as shown by the dotted lines, care should be taken to avoid breaks. The fiber unit is held on the form by two or three turns of friction tape. A circuit diagram of the windings for the transformer is shown in

DIMENSIONS FOR CORE



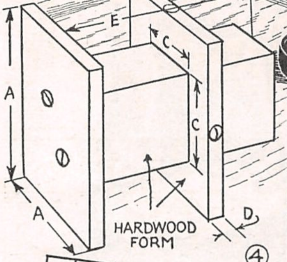
A: 25 TO 40-CYCLE CORE

B: 50 TO 133-CYCLE CORE



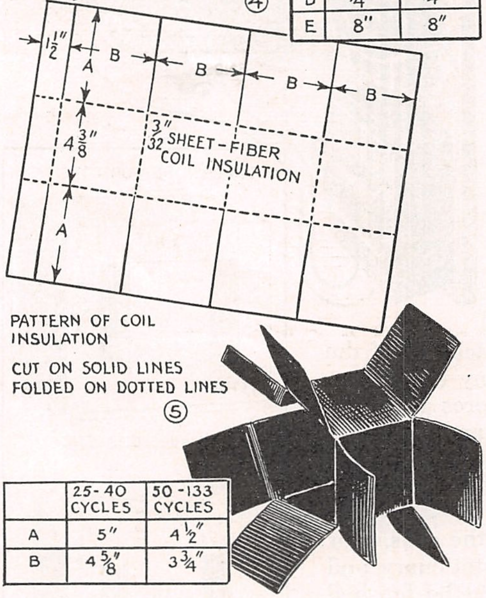
THICKNESS OF CORE (COMPRESSED)	
25 TO 40 CYCLES	50 TO 133 CYCLES
$4\frac{1}{4}$ INCHES	$3\frac{5}{8}$ INCHES
APPROX. WEIGHT OF CORE	
120 LBS.	70 LBS.

③



④

	25 TO 40 CYCLES	50 TO 133 CYCLES
A	$8\frac{3}{4}''$	$6\frac{3}{4}''$
B	$4\frac{3}{8}''$	$4\frac{3}{8}''$
C	$4\frac{5}{8}''$	$3\frac{3}{4}''$
D	$\frac{3}{4}''$	$\frac{3}{4}''$
E	8″	8″



PATTERN OF COIL INSULATION

CUT ON SOLID LINES
FOLDED ON DOTTED LINES

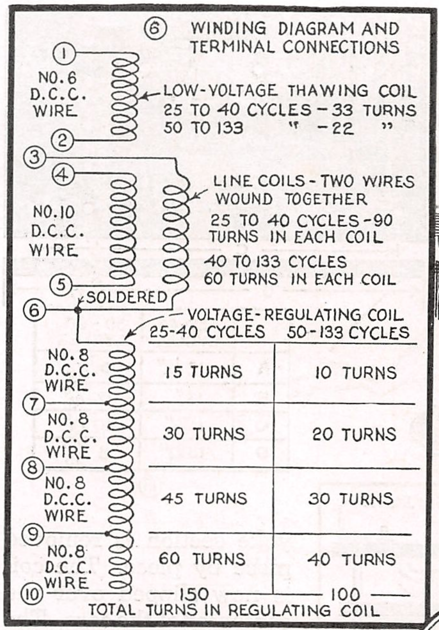
⑤

	25-40 CYCLES	50-133 CYCLES
A	5″	$4\frac{1}{2}''$
B	$4\frac{5}{8}''$	$3\frac{3}{4}''$

Fig. 6. Wind the low-voltage thawing coil with No. 6-ga. d.c.c. wire as in Fig. 7. The starting end of the wire, which should be left 15 in. long, is marked No. 1. The last turn of wire is fastened with shoemakers' linen thread and the end, also left 15 in. long is labeled No. 2. Then the coil is painted with orange shellac and wrapped tightly with one layer of plain linen tape.

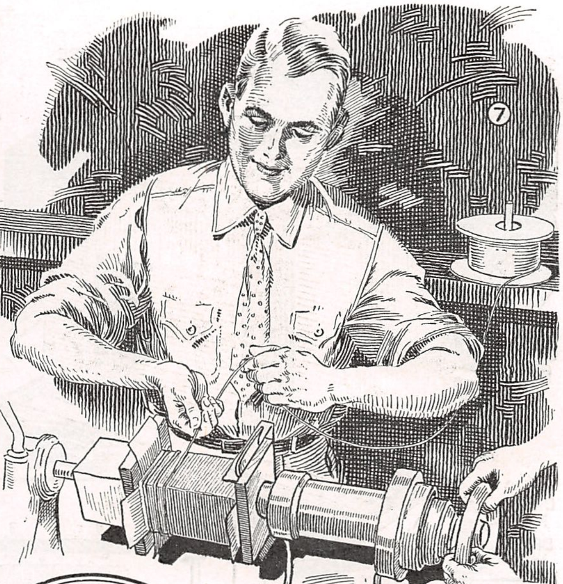
Next come the line coils. Two spools of No. 10-ga. d.c.c. wire will be required. Two wires "in hand" are wound together. Starting ends, left 15 in. long, are labeled Nos. 3 and 4. The wire is wound tightly and a layer of varnished cambric or brown paper should be put between layers. The finish ends, cut off so that 12 to 15 in. extend, are temporarily tied together, and marked Nos. 5 and 6. The ends of the coil should be tied down with linen thread, shellacked and wound with linen tape as before.

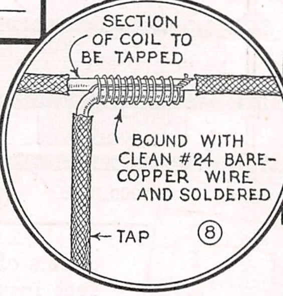
For the voltage-regulating coil, use No. 8-ga. d.c.c. wire. It must be wound in the same direction as the line coils. The start end of the voltage-regulating coil should be left extending 10 in. and labeled "start of voltage-regulating coil." After testing, this start end will be attached to lead No. 6. In the case of a 60-cycle transformer, 10 turns are wound on before tapping. See Fig. 6. For the 25-cycle job, 15 turns are required. At this point the insulation is removed from the No. 8-ga. wire for a distance of 1½ in. and an 18-in. length of No. 8-ga. wire is spliced on to serve as a tap lead as in Fig. 8. This lead is marked No. 7. After making the tap connection, one layer of electricians' rubber tape is applied. This is covered with a layer of friction tape. The winding is then continued with the No. 8-ga. wire until the number of turns required for the next tap

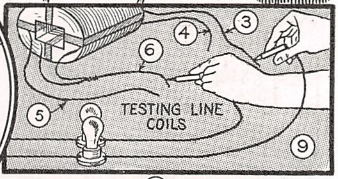

⑥ WINDING DIAGRAM AND TERMINAL CONNECTIONS
①
NO. 6 D.C.C. WIRE
LOW-VOLTAGE THAWING COIL
25 TO 40 CYCLES – 33 TURNS
50 TO 133 " – 22 "
②
③
④
NO. 10 D.C.C. WIRE
LINE COILS – TWO WIRES WOUND TOGETHER
25 TO 40 CYCLES – 90 TURNS IN EACH COIL
40 TO 133 CYCLES 60 TURNS IN EACH COIL
⑤
SOLDERED
⑥
VOLTAGE-REGULATING COIL
NO. 8 D.C.C. WIRE
⑦
NO. 8 D.C.C. WIRE
⑧
NO. 8 D.C.C. WIRE
⑨
NO. 8 D.C.C. WIRE
⑩

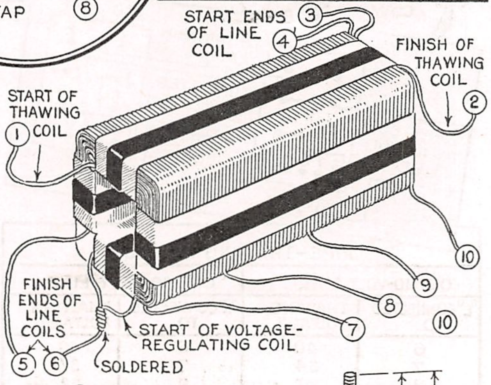
25-40 CYCLES	50-133 CYCLES
15 TURNS	10 TURNS
30 TURNS	20 TURNS
45 TURNS	30 TURNS
60 TURNS	40 TURNS
150	100

TOTAL TURNS IN REGULATING COIL

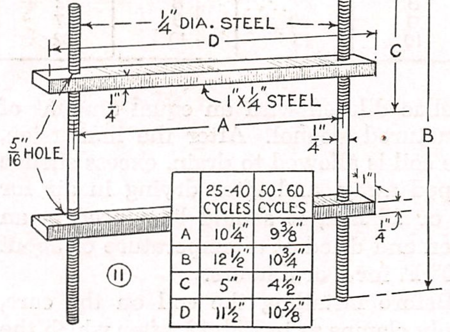



SECTION OF COIL TO BE TAPPED
BOUND WITH CLEAN #24 BARE-COPPER WIRE AND SOLDERED
TAP
⑧

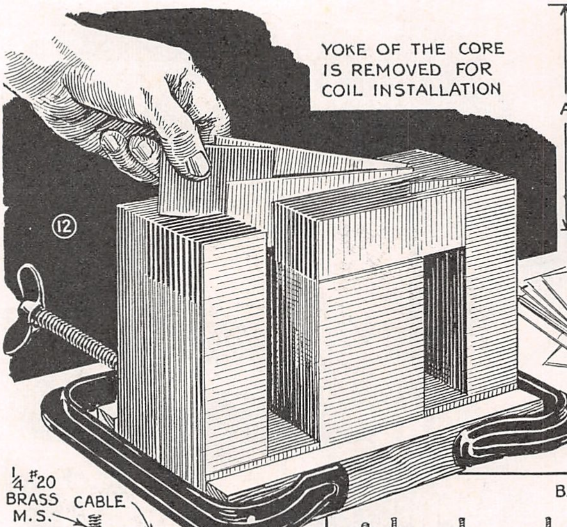

③
④
⑥
⑤
TESTING LINE COILS
⑨

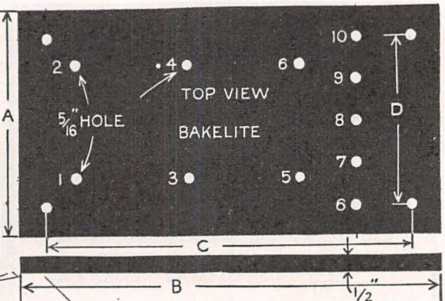

START ENDS OF LINE COIL ③ ④
FINISH OF THAWING COIL ②
START OF THAWING COIL ①
⑩
⑨
⑧
⑦
FINISH ENDS OF LINE COILS ⑤ ⑥
START OF VOLTAGE-REGULATING COIL
SOLDERED
⑩

have been wound in place. This will require 20 turns additional in the case of a 60-cycle unit, and 30 turns additional in the case of a 25-cycle transformer. This procedure is continued until the total number of turns required are in place. The tap leads should be labeled immediately with numbers corresponding to those shown in Fig. 6. The finished set of coils are next bound securely with shoemakers' linen thread. The wood screws holding the sliding end of the form are loosened and the form pressed out of the coil. Following this, the protruding ends of fiber are formed around the coil and fastened with friction tape. To determine the proper labeling for leads Nos. 5 and 6, connect two lamps as in Fig. 9. A prod connected to one of the lamps is attached to lead No. 3 and the other wire touched to first one and then the other of the finish ends of the line coil. The wire, which when touched causes both lights to burn, is labeled No. 6. The remaining wire is marked No. 5. The start end of the voltage-regulating coil should be neatly bent around the coil and connected to wire No. 6 as shown in Fig. 10. This splice should be made as in Fig. 8. The finished coil is immersed for 15 or 20 min. in orange


¼" DIA. STEEL
D
C
¼"
1"X¼" STEEL
A
¼"
B
5/16" HOLE
1"
¼"
⑪

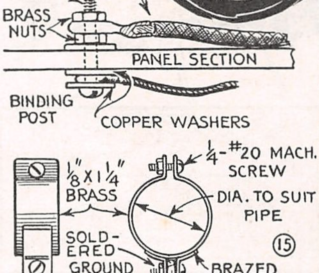
	25-40 CYCLES	50-60 CYCLES
A	10¼"	9⅜"
B	12½"	10¾"
C	5"	4½"
D	11½"	10⅝"

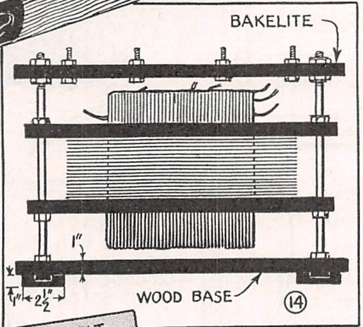

YOKE OF THE CORE IS REMOVED FOR COIL INSTALLATION
⑫

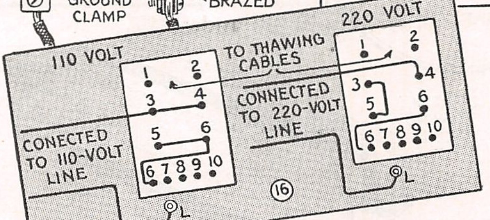

A
B
C
D
1/2"
TOP VIEW
BAKELITE
5/16" HOLE
1
2
3
4
5
6
7
8
9
10

	25-40 CYCLES	50 - 60 CYCLES
A	12 1/4"	9 15/16"
B	13"	12 1/8"
C	11 1/2"	10 5/8"
D	10 3/4"	8 7/16"

⑬


1/4 #20 BRASS M.S.
CABLE
BRASS NUTS
PANEL SECTION
BINDING POST
COPPER WASHERS
1/8" X 1 1/4" BRASS
SOLD-ERED GROUND CLAMP
1/4-#20 MACH. SCREW
DIA. TO SUIT PIPE
BRAZED
⑮


BAKELITE
1"
1"
2 1/2"
WOOD BASE
⑭


110 VOLT
220 VOLT
TO THAWING CABLES
CONECTED TO 110-VOLT LINE
CONNECTED TO 220-VOLT LINE
1
2
3
4
5
6
7
8
9
10
L
⑯

PIPE-THAWING VOLTAGE

ON 110-VOLT LINE		ON 220-VOLT LINE	
"L" CONNECTED TO	THAWING VOLTAGE	"L" CONNECTED TO	THAWING VOLTAGE
6	40	6	40
7	34	7	37
8	27	8	32
9	20	9	27
10	15	10	22

shellac diluted with an equal amount of denatured alcohol. After the immersion, the coil is allowed to drain, excess shellac wiped away, and after drying in air for 10 or 12 hrs., it should be placed in an oven and dried at a temperature of about 200° F. for 4 or 5 hours.

Before installing the coil on the core, apply clamps as in Fig. 12, after which the yoke section is removed piece by piece. The coil is now slipped over the center leg of the core. The coil leads should be bent to one side to prevent them from coming in contact with the core. If leads have been brought out at locations where they tend to rub metal, sheets of fiber are inserted to assure perfect insulation. After installing the coil, the laminations that were removed should be re-woven carefully into place and then they are tapped on top and sides with a block of wood to even them up, care being taken to avoid damaging the coils.

Fig. 11 shows clamps to mount the transformer. The clamps are placed on the ends of the transformer core and the nuts drawn lightly. At this point, orange shellac is generously applied to the entire core so that it runs between the laminations after which the clamps are drawn down tight while the shellac is soft. Fig. 14 shows a side view of the transformer while Fig. 13 shows details for drilling binding-post holes in the terminal board. The holes have been given numbers corresponding to the numbers on the leads. Fig. 15 shows how heavy wires are connected to ¼-in. brass screws used as binding posts. The connections must be mechanically strong and well soldered.

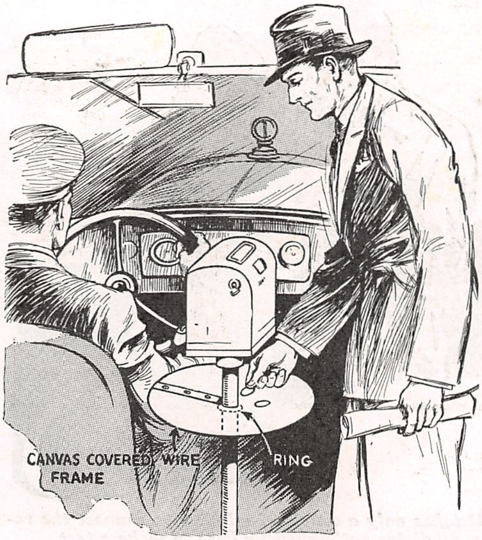
The terminals marked Nos. 1 and 2 in Fig. 16 are connected to heavy cables to conduct the low-voltage electric current from the transformer to the frozen pipes. Use single-conductor arc-welding cable rated at 200 amps. for this purpose, one lead 5 ft. long the other 40 ft. One end of each should be equipped with heavy lugs to fit the ¼-in. binding posts. Brass nuts are used to hold the lugs in place. The operating ends of these cables are fitted with heavy-duty ground clamps as in Fig. 15. Connections to the remaining binding posts are made as in Fig. 16. Use No. 8-ga. wire. The wire used to connect the transformer to the power supply should consist of 50 ft. of double-conductor round mining-machine cable. The two wires of the cable should be separated at both ends, stripped for 1 in. and soldered to lugs. The lugs at one end go to the transformer terminal board as in Fig. 16, while those at the other end are fastened to the load side of the cut-out switch at the meter as in Fig. 1.

Pipe-thawing equipment of this type should never be connected to an ordinary light outlet as the wiring is too light. Likewise, it is not satisfactory to use clips for connecting the ends of these cables to the power supply. The connections should be made by attaching the cable lugs to the power supply with the screws found at the load side of the cut-out switch. A variety of voltages may be had by changing the connections at the terminal board. See Fig. 16. When terminal L is connected to binding post No. 6, the thawing voltage will be maximum. This voltage should be used only when long spans of pipe or large pipes are to be thawed. When L is connected to No. 10, the minimum voltage is 15 volts on a 110-volt line or 22 volts on a 220-volt line. In no case should the highest voltage be used on a short length of pipe as this is likely to blow even 30-amp. fuses. The unit works best when it delivers about 2,000 watts.

Protecting Trees Against Rabbits

Rabbits can be prevented from gnawing fruit trees by painting the lower part of the trunks with a mixture consisting of rosin, 7 lbs., unsaturated fish oil, 3 lbs., and copper oleate, 3 lbs. The ingredients are stirred together over a slow fire, and the warm mixture applied to the trees.

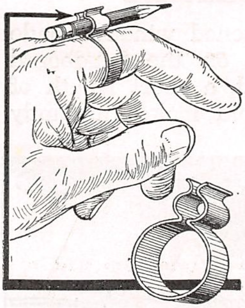
Coins Dropped Near Bus Meter Caught in Cloth Frame



Coins dropped by passengers while paying their fare in this bus are caught in a receptacle

After losing many coins dropped by passengers when trying to insert them in the meter, one bus driver, who had to make up the loss from his own pocket, rigged up a canvas receptacle under the meter to catch the coins. The receptacle was made by stretching canvas over a circular wire frame, attached to the meter support.

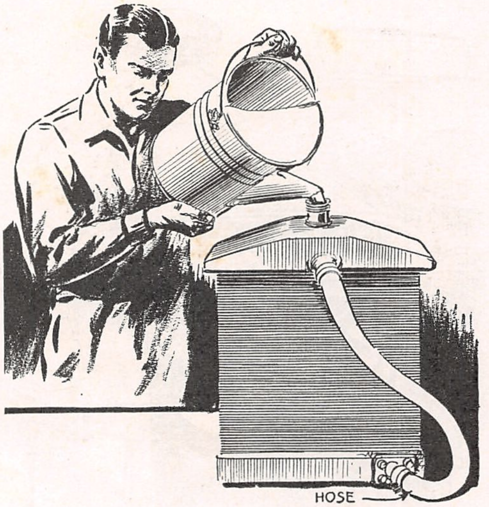
Billing Clerk "Wears" Pencil on Index Finger



One billing clerk solved the problem of always having a pencil at hand by wearing it on his finger. To do this, a holder was shaped from a piece of spring brass as shown. This left both hands free for handling packages and boxes, yet by merely crooking the finger the pencil was brought into service for checking items.

¶An ordinary blackboard eraser is excellent for cleaning the top of a stove.

Testing Radiator for Leaks with Aid of Hose

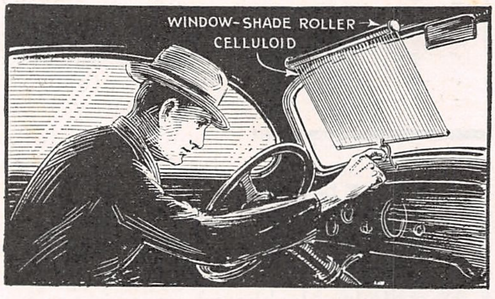


It takes only a couple of minutes to connect the radiator outlets with a hose to make a test

Instead of plugging the outlets of a radiator when testing it for small leaks, one mechanic finds that he can save considerable time by slipping the ends of a length of hose over the outlets as shown. If lengths of hose of various diameters are kept handy, it's only a matter of a few minutes to slip one of them over the outlets and tighten the hose clamps.
—Elmer A. Vandrey, Truman, Minn.

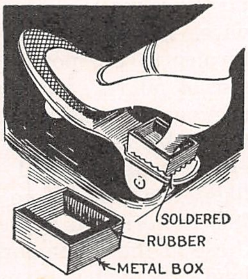
Glare Shield on Shade Roller Easily Controlled

Tacked to a shortened window-shade roller and mounted on the headboard above the windshield, a short length of colored sheet celluloid makes a dandy glare shield, which can be lowered instantly to any height desired. The regular roller brackets can be used to mount the assembly. It is a good idea to provide a ring at the bottom of the shield to engage a small hook mounted on the cowling to prevent flapping in the wind.



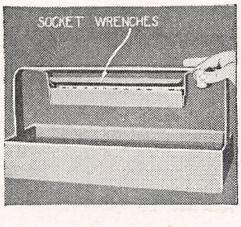
This adjustable glare shield is instantly raised or lowered to any height desired

Heel Is Held on Accelerator by Small Metal Box



Woman drivers who have difficulty in keeping the high heels of their shoes on the accelerator will find that a shallow metal box soldered to the lower end of the pedal as shown will solve the problem. It will, of course, be necessary to remove part of the rubber covering of the pedal and clean the metal before soldering the box in place.

Socket Wrenches Kept Handy



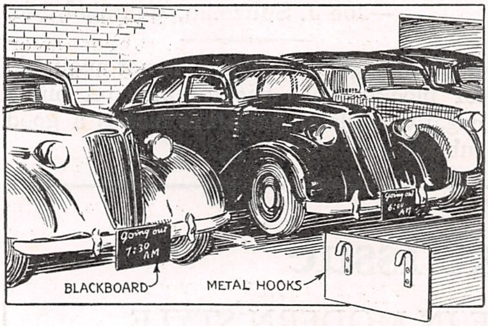
To assure that his socket wrenches would always be at hand, one mechanic suspended the metal container in which he kept them from the handle of his tool box as shown. This was done by welding short lengths of flat iron to the ends of the container and to the underside of the toolbox handle.—Jos. C. Coyle, Tucson, Ariz.

Effects of Clogged Muffler

Clogged mufflers are sometimes the cause of motor trouble often diagnosed as late spark, low compression, carburetor trouble, or a number of other things which have no direct relation to the real cause of the trouble. Where the muffler is only partly clogged the chief characteristic is a loss of power and a corresponding sluggish pickup. If there is no reason for suspecting the mechanical condition of the engine, the muffler can be checked easily by loosening the flange connection at the exhaust manifold so that a good-sized leak is created and then testing for engine performance. A completely clogged muffler may cause the engine to stop. In such cases, the resulting high pressure in the exhaust line will show as a leak which persists even after the engine has stopped.

Blackboards in Parking Garage Speed Up Service

To assure that the motorist's wishes as to service would be carried out correctly by the attendants, the owner of one parking garage made up a number of small blackboards which could be hung on the bumpers. When a motorist drove in, he was handed a blackboard on which he wrote the time he wanted the car delivered in the morning or any servicing, such as greasing, washing, oil changing, etc. This served as a reminder to the attendants to have the car ready.



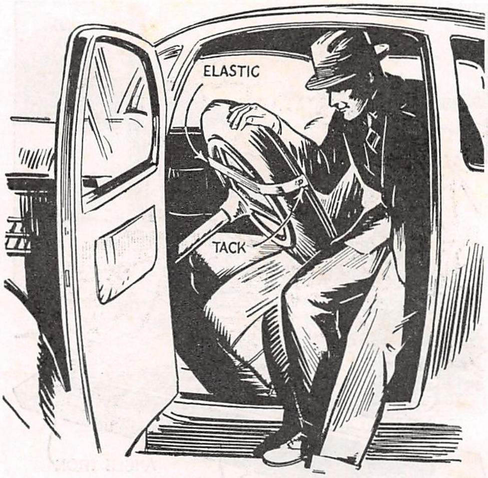
Service information written on bumper blackboards in this garage reminds attendants to have car ready

Horn-Button Contacts Shunted to Avoid Arcing

Warning horns used on some cars pull heavy currents in starting and when blown for only a moment often arc at the horn-button contacts, which soon burns them so badly that a resistance is set up at this point, resulting in sluggish operation. This trouble can be avoided by shunting a small condenser across the contacts, which minimizes arcing. Then the horns will respond to a touch of the button.

—Emil J. Novak, Omaha, Nebr.

Coach Seat Tipped Forward Is Held by Strap

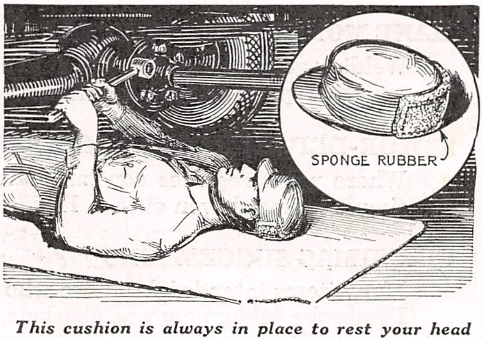


Driver's seat in coach car held against steering wheel by elastic strap

When loading and unloading his coach-type car, one motorist finds that an elastic band, tacked to the sides of the seat as shown to hook over the steering wheel, is handy for holding the seat when tilted forward. If the seat frame is of metal so that tacks cannot be used, the ends of the elastic can be sewed to the upholstery.

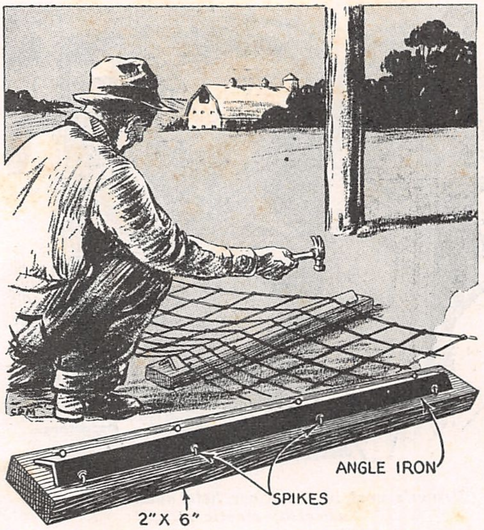
Mechanic's Head Cushioned When Working on Car

Sewed to the back of a mechanic's cap, a rectangular piece of sponge rubber will provide a good head cushion. Such a cushion is always in place and there is no time lost in hunting for it when you have to get under a car.



This cushion is always in place to rest your head when you crawl under a car

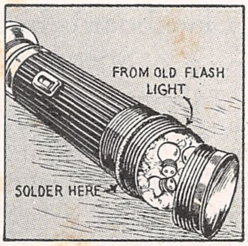
Woven-Wire Fencing Quickly Cut on Piece of Angle Iron



A few sharp blows of a hammer will cut woven-wire fencing with this cutter

When repairing or putting up a fence, one farmer uses a piece of angle iron to cut the wire. The iron is mounted upside down on a short plank and is spiked in place. To use the cutter it is slipped under the wire, after which each stay is struck a sharp blow with a hammer.

Bulbs Carried in Flashlight



Plumbers, electricians and others who often have to use a flashlight in their work can easily carry a supply of extra bulbs by using the bottom of an old flashlight. The screw end and cap are sawed off the old light and are soldered to the cap of the one you use, thus providing a handy receptacle for bulbs that is always at hand.

—Joe J. Sultzman, Hannibal, Mo.

¶When regular "opaque" is not available for blocking out backgrounds on photo negatives, black India ink makes a good substitute.

The Next Issue

COMPLETE BEDROOM SUITE IN MODERN STYLE

Simplified construction of this furniture puts it within the reach of all. There are four units; a twin-cabinet vanity for use with a full-length mirror hung on the wall, an octagon-sided dressing seat, a low, double bed and a chest.

GAS-DRIVEN MODEL PLANE BUILT FOR SPEED

Just what you have been looking for!—copy of the plane that won Bendix and Thompson trophies at the 1935 National Air Races. Has a 66-in. wing spread.

MAKE MONEY WITH A LARGE ARC WELDER

Welding generator coupled to auto motor on wheeled chassis; can be towed for making repairs on farm machinery or kept in the garage for car repair work.

MOTOR-DRIVEN BENCH HACKSAW

Where work requires constant cutting with a hacksaw, why not make this simple motor-driven outfit? Handy in metal-working shops and garages.

CHRISTMAS SUGGESTIONS

Many items intended for those who want to make unusual gifts. A handsome Pembroke table, new wastebaskets, modern doll house, child's clothes chest.

MORE THRILLS THAN EVER

with the NEW 1937 HARLEY-DAVIDSONS

What a wonderful line-up — those 1937 Harley-Davidsons! When you cast your eyes on their new lines, flashy new colors, built-in instrument panels, and 120 M.P.H. speedometer dial—you'll say they're the classiest outfits you ever saw! These 1937 Harley-Davidsons sure have improvements galore! New circulating pressure oiling—roller bearing motors—double loop trussed frames—welded steel saddle-type tanks. Longer motor life — increased gas and oil mileage — greater sustained horsepower — greater strength — easier handling. . . And, Boy! — when you ride one of these 1937 Harley-Davidsons you KNOW you're going places! See your nearest Harley - Davidson dealer *right away.*

Take a FREE ride on a 1937 Harley-Davidson — ask about his Easy Pay Plans. And send in the coupon.

Ride a

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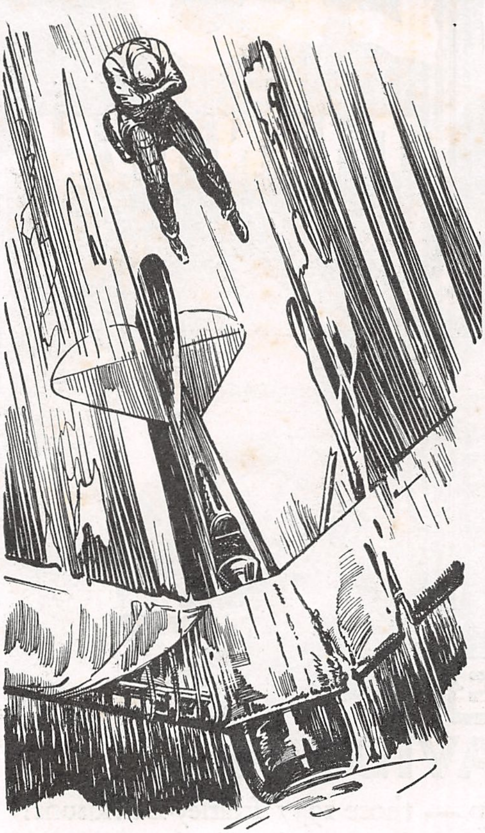
Interested in motorcycling. Send illustrated literature. Postage stamp is enclosed to cover mailing cost.
Name..
Address..
....
My age is ☐ 16-19 years, ☐ 20-30 years, ☐ 31 years and up, ☐ under 16 years. Check your age group.

AMERICA'S NO. 1



LEE GEHLBACH

THE TEST DIVE!

Straight down from 4 miles up—motor roaring—struts screaming—Gehlbach tears earthward like a bullet flashing from a revolver. At the bottom of the 2-mile drive—a sharp, wracking pull-out wrenches plane and pilot to the limit. Such tests make planes safer. But anything can happen. A bump in the air—a tiny flaw, and the plane can fly to pieces as though dynamited while the pilot takes to his parachute. But Lee Gehlbach eats heartily and *enjoys* his food. Note the Camel cigarette in his hand—one of the many Camels that Lee enjoys during and after meals. In his own words *(below)*, he gives you the reason why Camels are his cigarette.

"SMOKING CAMELS KEEPS MY DIGESTION TUNED UP AND RUNNING SMOOTH"——SAYS LEE

"CAMELS set me right!" Gehlbach says. "You know, chance is only 10% of my business. Keeping alert and in fine condition is the other 90%. I smoke Camels while I'm eating, and afterward, for digestion's sake. And when I say that Camels don't get on my nerves, it means a lot."

Good digestion and healthy nerves are important for everyone in this wide-awake era. So make Camel *your* cigarette. Enjoying Camels at mealtime and after speeds up the flow of digestive fluids—increases alkalinity—helps bring a sense of well-being. Smoke Camels—for digestion's sake—for their refreshing "lift." Camels set you right! And they do not get on your nerves.

HOLLYWOOD RADIO TREAT! Camel Cigarettes bring you a FULL HOUR'S ENTERTAINMENT! Benny Goodman's "Swing" Band... George Stoll's Concert Orchestra... Hollywood Guest Stars... and Rupert Hughes presides! Tuesday—9:30 pm E.S.T., 8:30 pm C.S.T., 7:30 pm M.S.T., 6:30 pm P.S.T., over WABC-Columbia Network.

FOR DIGESTION'S SAKE

TEST PILOT

stands terrific strain in his meteoric power-dives and blinding pull-outs, as planes fall apart in mid-sky!

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CAMEL
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TURKISH & DOMESTIC BLEND CIGARETTES
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Tobacco Company,
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SMOKE CAMELS

Future Titans of the Skies

(Continued from page 885)

Instead of being assembled in factories the flying boats would have to be constructed in shipyards or "planeyards." The hulls would be launched like any other kind of ship. Flying bases adjacent to the open ocean would be necessary because it might take half as long to taxi at legal speed down the length of New York harbor as it would to fly the rest of the way to Europe.

The type of power plant that would be used will depend upon the outcome of the unceasing competition between designers of gasoline engines, Diesels, and steam. Right now gasoline engines have the edge in light weight per horsepower. In this theoretical liner three pounds per horsepower are allotted for engines, enough to permit heavier Diesels to be used, and even admitting steam as a strong contender. The Velox system of manufacturing steam eliminates the heavy boilers and many engineers think that steam will be the most practical source of power for heavy airplanes.

Engineers generally agree that the big boats will have four propellers, each operated by a 50,000-horsepower engine unit. The big airplanes will theoretically cruise at seventy per cent of full power, and by dividing the power into four packages, this division permits total failure of one engine unit without crippling the ship.

Figuring out the propellers for the super air liner brought a real surprise. They must be five-bladed, it was concluded, and sixty feet in diameter. They will revolve at only 200 revolutions per minute at cruising speed. This seems a dangerously low speed but it is tip speed that counts instead of revolutions per minute, and with such long blades the tip speeds will be more than enough. The propellers will need to be mounted on hollow shafts twenty inches in diameter and will cost about $1,000,000. A large part of this amount would go for preliminary research.

These days no designer merely hopes that his new plane will fly. He knows that it will. Formulas, backed up by wind-tunnel tests of models, give him an accurate idea of a plane's capabilities even before the raw materials are ordered. The latest wind-tunnel test is to use a model equipped with an electrically driven propeller so that the actual effect of the slip stream may be measured. Another test is to fasten short pieces of string to the wings. When the strings begin to flutter in the wind tunnel, observers know that the stalling angle of the wing has been reached.

Much of the success of the flying boats will depend upon the hot-wire anemommeter, a small piece of hot wire used instead of smoke to measure the flow of air around wind-tunnel models. The electrically heated wire, placed near some part of the model, loses temperature according to the speed of the wind that flows past it, and these temperature changes in turn affect the conductivity of the wire. This allows electrical fluctuations to be translated directly into terms that show the efficiency of the model's shape.

Will the future giants of the air pay their way? Yes, the flying-boat designers declare. Not only that, but they should show higher profits than the large surface ships. Comparing the 1,500-ton flying boat with the "Queen Mary," Kleinhans points out that in two weeks of operation the plane would make five round trips while the surface ship accomplishes one round trip. Yet each could transport the same number of passengers in that time. On such a schedule the flying boat would be operated for 110 hours against 200 hours for the "Queen Mary." Capital charges for retiring the initial cost would be half as much, crew and food costs would be much less, while wharfage, ticket selling, and other fixed charges would be about the same. Fuel bills would compare closely.

Kleinhans estimates that on a schedule of two round trips per week in the Atlantic service, carrying an average of sixty per cent passenger capacity, the flying boat should show a net profit of $3,000,000 at the end of five years. This amount would be left after deductions for capital amortization, interest, and all other expenses, and would be based on a charge of about $300 per round-trip ticket. The safe life of a flying boat is longer than five years, hence profits would be at a higher rate during the additional time that the boat is in commission.

KODAKS stay up late now

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A WIZARD picture taker outdoors—but how do you rate indoors, at night? Faster films, improved lighting open a new and exciting field to your skill. There's an endless variety to indoor picture opportunities.

Night pictures can be made with your present camera provided that it can be set for "time"; and if it is equipped with an *f*.6.3 or faster lens, then night *snapshots* are easily possible. Just load with Kodak "SS" or Kodak Verichrome Film and use Mazda Photoflood or Photoflash lamps.

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First get the FREE booklet at your dealer's . . . then you're ready to shoot. It explains everything about pictures at night . . . which film to use . . . how to set your camera . . . suggests a variety of picture opportunities... Eastman Kodak Company, Rochester, N. Y.

PICTURES
AT NIGHT INDOORS
EASY NOW
TH ANY CAMERA
SUPER SENSITIVE PANCHROMATIC
Kodak Film
EASTMAN KODAK CO.
Kodak
SUPER SENSITIVE PANCHROMATIC

Accept nothing but the film in the familiar yellow box —Kodak Film—which only Eastman makes.

The Amazing Story of the Automobile

(Continued from page 893)

among Bothwell's collection is now held by a 1909 Mitchell, which recently turned seventy-five miles per hour.

Then there is the evolution of brakes. In the early models the foot brake was almost unknown. The hand brake and the gear shift lever are outside the frame. The steamer has no conventional brakes at all. A brake drum ten inches in diameter was considered large in those days.

A drive in one of Bothwell's cars engenders a new appreciation for the vast corps of technicians who have helped to smooth out the "bugs" so plentiful in the old timers. His cars steer like trucks. They start with a jerk, and stop in any manner they feel like. They make a noise like a rock crusher, and ride like a covered wagon. But all the essentials of the modern motor car are there—in embryo, but there nevertheless.

Even the rumble seat can be found among the collection. There is a rumble seat on a 1904 Auto Car. There in this strange collection is the saga of the auto, the saga of turning wheels which changed the life of this planet.

Tires have also had their period of evolution. The 1900 Sears in this collection had no rubber tires at all, but ran on iron-tired wagon wheels. Next came small high-pressure rubber tires, adapted from those used on bicycles.

When the world war opened, in 1914, the average American motorist was riding on tires only three and one-half inches in cross-section, inflated at eighty pounds pressure. They were little better than solid tires, and lasted for a couple of thousand miles.

By 1918, tire cross-sections had increased to four inches and were carrying sixty pounds of air. Five years later, when the first so-called "balloon" tires had been introduced, tires were half an inch larger in cross section and were carrying fifty-five pounds pressure. In 1927, the 5.25-inch tire was the most popular and tire engineers advised these could travel on only thirty-six pounds of air.

Since 1930, tire cross-sections have been increasing by fractions of inches and air pressures have been dropping, until the six-inch tire, carrying thirty pounds of air, was replaced on 1936 cars by the six and one-half inch tire, which requires only twenty-six pounds of air. Thus, in two decades, tire cross-sections have practically doubled, while recommended air pressure has been reduced to less than one-third of what it used to be.

Back in 1912, the average three and one-half inch tire was mounted on a wheel with a diameter of twenty-four inches. The six-inch tire of 1930 was built to fit an eighteen-inch rim. Three years later, cars were closer to the ground and the six-inch tire was mounted on a seventeen-inch wheel. The average tire of 1936 is six and one-half inches in cross-section and mounted on a sixteen-inch wheel.

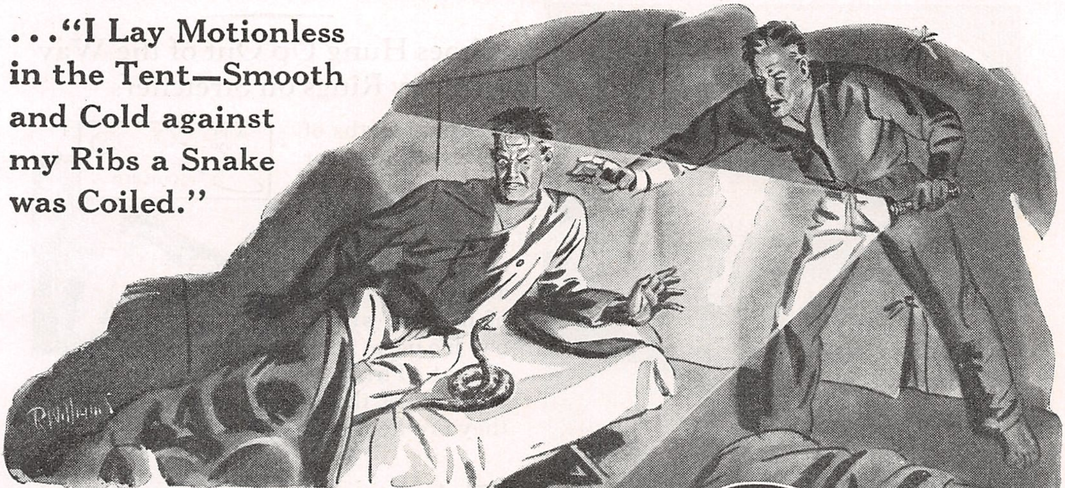
The early tire was the so-called "fabric tire," made of cross-woven material in which vertical or warp members were interwoven at right angles with fill members, both warp and fill being on the same size and strength cord. These tires were rigid and rode roughly, due to the high air pressure necessary to obtain satisfactory performance from them. They gave from 3,500 to 5,000 miles of service. "Cord tires," made by running the cords in one ply across the tire at right angles to those in the adjacent ply, came next and mileage was raised to 15,000 to 18,000 miles.

The first direct move to improve riding qualities resulted in the "balloon" tire, differing from the cord in that it was built of larger volume and so supported the same load as the "cord" at lower air pressure. In this way, a softer-riding tire was obtained. However, since these tires were softer, they deflected at a sharper angle on the sidewalls and broke them down at this point at an early mileage. By developing fatigue-resisting cord fabric and tougher tread stock to afford rapid and irregular tread wear, manufacturers put 20,000, 25,000 and even 30,000 miles of wear, comfortable riding and good service into the balloon tire that is used generally today.

¶Names and addresses of manufacturers and dealers in articles described in this magazine will be furnished by our Bureau of Information upon request accompanied by stamped, self-addressed envelope.

'STARK TERROR WAS SQUEEZING AT MY HEART'

. . . "I Lay Motionless in the Tent—Smooth and Cold against my Ribs a Snake was Coiled."

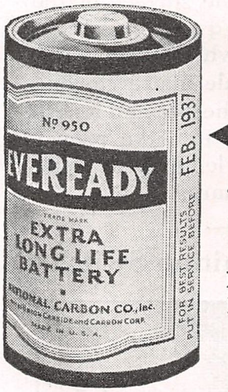


"Something in my voice woke my companions from their deep sleep," writes George F. Jackson. "Fighting for self-control, I told them quietly what had happened. One turned his Eveready flashlight on my cot. The other carefully pulled my blankets down . . . to reveal a big, deadly copperhead, coiled to strike where no first-aid could have saved me!

"The flashlight beam moved a little, and we noticed the snake followed it with his beady unblinking eyes . . . My friend moved the light slowly, farther and farther. The snake continued to turn his hideous head. Gradually he began uncoiling to keep his eyes on the light. Now the snake was facing directly away from me . . . my other companion reached quickly for me, gave a mighty heave and I sailed out of my bunk and against the tent wall. Then I fainted, while they killed the deadly reptile.

"But for the *fresh* Eveready batteries that kept that light strong and steady through this horrible emergency, there could have been no happy ending. Needless to say I never take chances any more on batteries that may have grown old on a dealer's shelf."

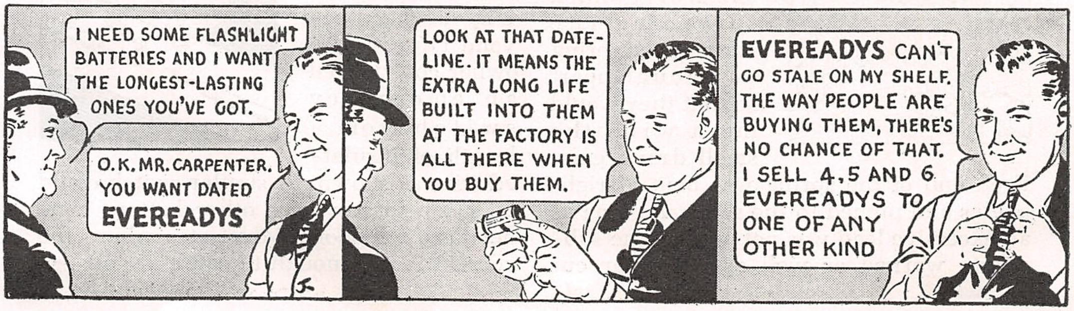
George F. Jackson, saved from death as venomous reptile is hypnotized.


No 950
EVEREADY
TRADE MARK
EXTRA LONG LIFE BATTERY
NATIONAL CARBON CO., Inc.
UNIT OF UNION CARBIDE and CARBON CORP.
MADE IN U.S.A.
FEB. 1937
FOR BEST RESULTS PUT IN SERVICE BEFORE

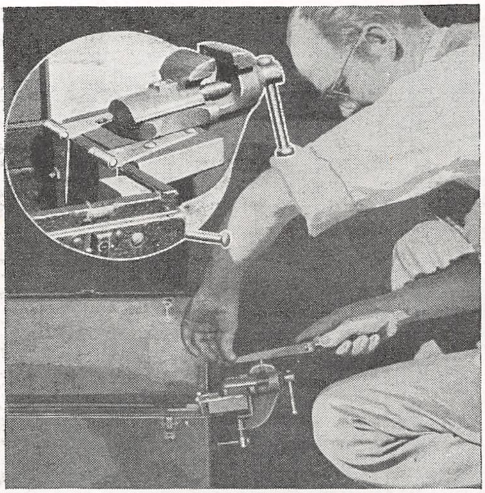
EVEREADY BATTERIES ← ARE *FRESH* BATTERIES

NATIONAL CARBON CO.,
INC., 30 East 42nd Street,
New York, N. Y.

Once More the DATE-LINE is a LIFE-LINE


I NEED SOME FLASHLIGHT BATTERIES AND I WANT THE LONGEST-LASTING ONES YOU'VE GOT.
O.K. MR. CARPENTER. YOU WANT DATED EVEREADYS
LOOK AT THAT DATE-LINE. IT MEANS THE EXTRA LONG LIFE BUILT INTO THEM AT THE FACTORY IS ALL THERE WHEN YOU BUY THEM.
EVEREADYS CAN'T GO STALE ON MY SHELF. THE WAY PEOPLE ARE BUYING THEM, THERE'S NO CHANCE OF THAT. I SELL 4, 5 AND 6 EVEREADYS TO ONE OF ANY OTHER KIND

Bench Vise Hinged to Tool Kit Is Always at Hand

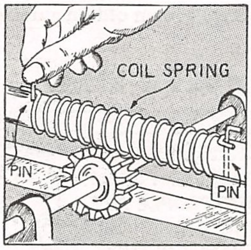


Folded inside your tool kit, this vise takes little space and is always ready for use

With the aid of two strap hinges and a small block of hardwood, a light bench vise can be fitted onto a locksmith's tool kit to save time and steps on key-making jobs away from the shop. The hinges are bolted to one end of the tool case on the inside, and to the block which serves as a support for the vise clamp, as indicated in the photo. When not in use, the assembly folds inside the kit out of the way.

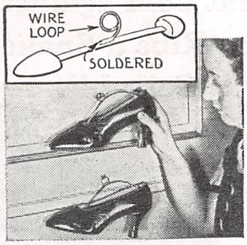
—James McQueeny, Kansas City, Mo.

Worm Gear for Model Mechanism Improvised from Coil Spring



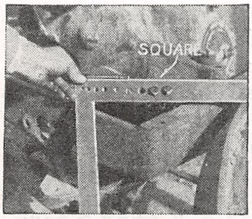
In constructing a model where a worm gear was required and none was available, a substitute was improvised by fastening a snug-fitting coil spring on the worm shaft, spreading the turns of the spring far enough apart so that they would mesh with the small drive gear. Each end of the spring was bent at right angles and pinned to the shaft. As long as an excessive load was not applied the substitute worked as well as a regular cut worm. If you find that the load is too great and that the spring spreads as a result, the coil should be soldered to the shaft.

Shoes Hung Up Out of the Way by Rings on Stretchers



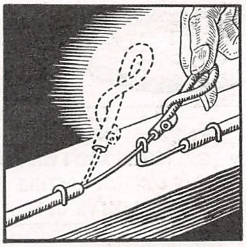
Short lengths of wire with loops or eyes formed on one end and soldered to shoe stretchers provide an effective means of hanging shoes on hooks in a closet. This not only makes the shoes handy to get at, but they are kept off the floor.

Bolts Sorted to Length and Size with Aid of Carpenter's Square



If several holes of different diameters are drilled in a carpenter's square, you will have a handy tool for sorting used bolts. The diameter of each hole is stamped in the surface of the square, after which it is a simple matter to find the size and length of a bolt by inserting it into the proper hole, and then laying it lengthwise along the ruled edge of the square.

An Emergency Ignition Switch



When the knife switch on a farm pumping engine became accidentally damaged beyond repair, the owner constructed an emergency switch from a length of insulated wire as shown. A similar switch could be made to serve for other battery connections, telephone wires, etc., where the current is not enough to cause arcing.

HALF & HALF MAKES ONE SWELL SMOKE!

LUCKY STRIKE
HALF AND HALF
BUCKINGHAM CUT PLUG
SMOKING TOBACCO
No Bite!

LUCKY
HALF AND HALF
BUCKINGHAM CUT PLUG
SMOKING TOBACCO
No Bite!

HALF AND HALF
BUCKINGHAM CUT PLUG
SMOKING TOBACCO
Still no Bite!

Sure you can smoke a pipe. Just try Half & Half. Cool as a wife saying: "Where have you *been?*" Sweet as your alibi: "Out with your dad." Fragrant, full-bodied tobacco that won't bite the tongue—in a tin that won't bite the fingers. Made by our exclusive modern process including patent No. 1,770,920. Smells good. Makes your pipe welcome anywhere. Tastes good. Your password to pleasure!

Not a bit of bite in the tobacco or the Telescope Tin, which gets smaller and smaller as you use-up the tobacco. No bitten fingers as you reach for a load, even the last one.

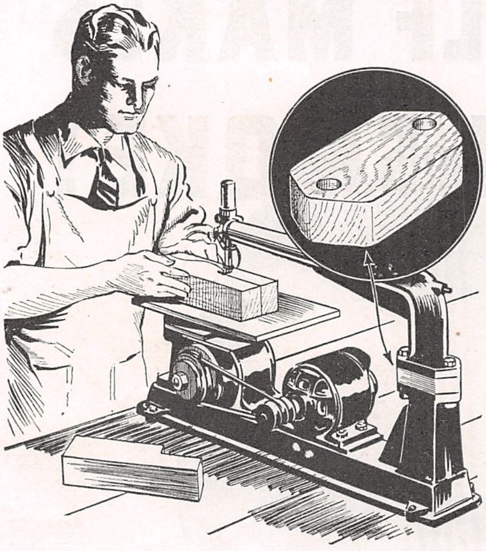
Copyright 1936, The American Tobacco Company

HALF AND HALF

The Safe Pipe-Tobacco

FOR PIPE OR CIGARETTE

Capacity of Jig Saw Increased by Raising Upper Arm



Capacity of some jig saws can be increased by using spacer block where the arm joins the base

If you want to use a jig saw on work a little too thick for its normal capacity, you may be able to raise the upper arm by using a hardwood block as shown. Blocks up to 1 in. in thickness will still permit the use of the regular saw blades. Care must be taken, however, to drill the block accurately so that the arm will not be thrown out of alinement.

—Ralph Pickard, Hawthorne, Calif.

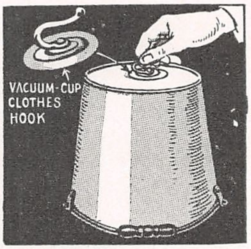
Library Paste Easily Made

A white, pearly library paste of unusual adhesive qualities can be made from white dextrine, 50 parts; water, 45 parts; and glycerin, 10 parts. The dextrine should be stirred with a small amount of water to form a thin cream, after which the rest of the water and the glycerin are added and the whole heated in a water bath for about 15 min. until the pearliness develops. The mixture can be put in a can and set in a pan of water over the fire, or you can use a double boiler. When the paste is ready to be bottled, stir in about half a teaspoonful of oil of cloves for each half pint of paste. The oil of cloves acts as a preservative and prevents mold from forming.

—R. Wailes, Bethesda, Md.

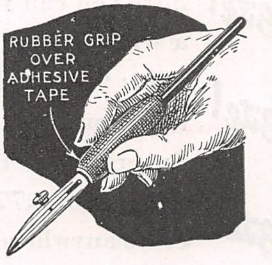
Soldered Jobs Tested for Leaks with Vacuum Cup

After soldering a pail, pan, tank, etc., it's a simple matter to test it for leaks, with a rubber vacuum cup, preferably one of the type that has a clothes hook attached as the hook will serve as a handle. Moisten the edges of the cup and press it over the soldered spot. If the job is air-tight, and the surrounding surface is smooth, the cup will stick tightly. But if there is a leak around the solder, air will get under the cup and it will not hold.



Ruling Pen Has Rubber Grip from Penholder

If you find that your ruling pen tires the fingers, when using it for long periods, the strain on the fingers often can be relieved by increasing the diameter of the pen where it is gripped. This is done by winding tape around the shank of the pen so that a rubber or cork grip from a regular penholder can be slipped over it. Before forcing on the grip, apply a little shellac to the tape so that the rubber will stay in place.


RUBBER GRIP OVER ADHESIVE TAPE

¶Mice may be prevented from frequenting shelves and closets if cayenne pepper or mint of any kind is scattered about the forbidden areas.

SEE WHAT MIGHTY MECHANICAL MARVELS YOU CAN BUILD WITH

The Great New

ERECTOR

Hello Boys!

Take a good look at that giant power plant! You build it yourself with the great new Erector. Piece by piece you construct its massive steel frame. Assemble its enormous flywheel, pistons and governor. Mount its big, shining boilers. Then you hook up the powerful Erector reversible electric engine and it throbs with action.

That's only one of the many exciting mechanical marvels you can build with the great new Erector. You can make that busy looking magnetic crane. Click the switch on the Erector engine—pull the control levers and it raises or lowers—swings to the right or left, just as your hand commands. Its magnet is so strong it grabs up steel girders before it touches them.

You can build *all* the engineering models shown in the picture and dozens more—with *one* Erector set. Enormous drawbridges that actually open and close. Towering airplane beacon that revolves just like the real ones. All-metal airplane. Dump-trucks. Walking beam engine. Ferris Wheel.

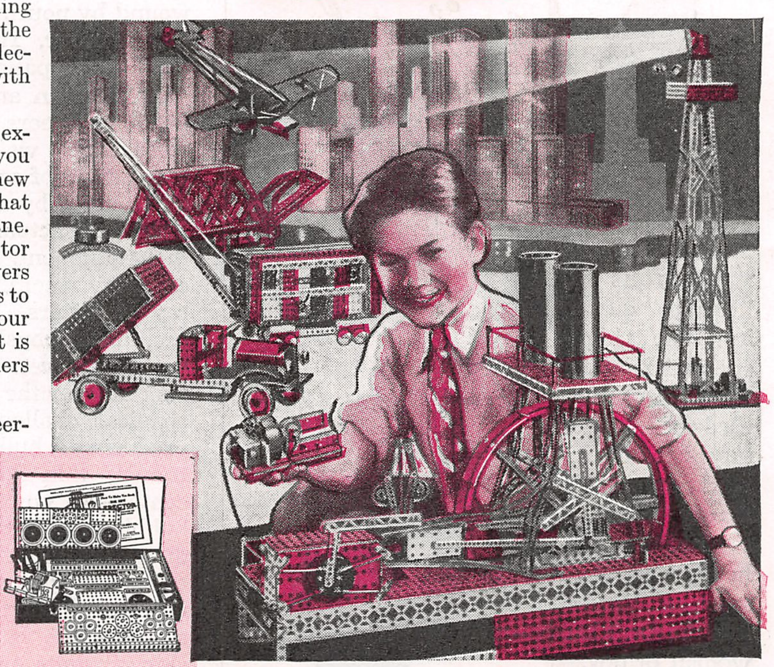
The great new Erector makes you a full fledged engineer—ready to build realistic, engine-driven models of the world's greatest mechanical marvels. There are more thrilling surprises packed in an Erector Set than anything you can own. Tell your Dad today that Erector is what you want most for Christmas.

Your friend,

A.C. Gilbert

Walking Beam Engine

Built with the No. 7½ set. Operated with the Erector Reversible Electric Engine.

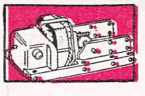


THE GREAT New ERECTOR

The construction set that has everything

***See the* Sensational No. 7½ Set**

12 pounds of exciting engineering parts. Has new Erector Reversible Electric engine. Girders and structural plates finished in red, yellow and blue. Glistening boiler shells. Big red wheels. Gears, pinions, big base plate and other parts for building all types of steam engines, derricks, trucks, bridges and over 100 action models. $10.00. Other Erector sets from $1.00 to $25.00.

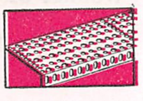


Erector Reversible Electric Engine

An adjustable power unit. Can be geared for different speeds.

Only ERECTOR

Makes the square girder with interlocking edges. Make stronger models with Erector than any other construction set.



ERECTOR — Big solid steel base plate

Sturdy foundation for stronger models

See The Gilbert Hall of Science

Scientific exhibits that will make you gasp with wonder. Look for these at your local toy store.

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36 big pages jam full of exciting pictures. True stories about boys in engineering, chemical research, sports, craftsmanship. Tells how to become a member of the Gilbert Engineering Institute and win a cash award. Free—mail this coupon at once.

Mail this coupon today for big free gift

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You bet! Rush—free—big Gilbert Thrills Magazine and advance news on the Great New Erector.

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REMOVE BLADE FROM DRIVER
INSERT CHUCK AND DRILL
"Yankee" TOOL BOOK

"YANKEE" Handyman Spiral SCREWDRIVER for $1

NEW AMAZING VALUE

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☆ Famous "Yankee" quality! Same as high-speed "Yankee" Spiral Screw-driver used for half a century by mechanics the world around. Now made "Handyman" size because of its many home uses, the time it saves, and the skill it puts into the user's hands—man, woman or boy.

No. 33 - H. Only **$1.00,** at your dealer's.

●

BORES HOLES, too, for small screws or other purposes around the home. Ask dealer for "Yankee" Chuck and 3 Drills, to fit "Yankee" *Handyman* Screwdriver. Sold separately, 39c set.

Fit in Place of Blade

"Yankee" Chuck & 3 Drills

INTRODUCTORY OFFER

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NEW TOOL! If not at dealer's, send us $1 with this coupon. Receive *postpaid* this ingenious "Yankee" *Handyman* that drives or draws screws at a *push* on the handle.

"Yankee" Tool Book, included FREE

*Name*____

*Address*____________________________________ (PM12)

The Miracles of Light

(Continued from page 852)

little bugs sometimes get through their vigilance. They may drop down from the air. They may hover in particles of sponge or rubber. Though ordinary flesh wounds can be pretty well cleaned with liquid sterilizers, a surgeon opening a human abdomen can't "germ-proof" this kind of wound by pouring in a pint or two of liquid sterilizer. That would probably be as hard on the patient as on the bacteria.

Dr. Hibben and his staff of light students, engineers, pathologists and medical researchers, visualize a device whereby every type of wound can be cleansed of all bacteria by means of lethal-ray light. They have actually invented and patented this equipment. The Westinghouse Lamp company recently shipped out 100 lethal-ray sterilizers. Each machine goes to a prominent physician or surgeon for experimental use. Thus far the equipment isn't safe for the amateur to use. The mechanical challenge is primarily one of producing a bulb with glass filters so extremely thin that the glass will tend to center the power of the tiny waves. A bubble process has been devised which reduces the thickness of the glass to about one-thirty-thousandths of an inch. In addition to killing microorganisms on flesh surfaces the lethal rays combat certain skin ailments such as ringworm and "athlete's foot," apparently caused by microorganisms that are first cousins to ordinary bread molds.

That's the human side of the lethal-ray story. The housekeeping side is but a short step away. Today we see the arrival of lethal-ray equipment to give the permanent knockout to every organism that may lurk on dinner plates, glasses, or cups. Most of these microorganisms are comparatively harmless. Yet if you and I were shown enlargements of the infinitesimal plant and animal life that settles upon the cleanest of chinaware wholly without invitation, we would probably indulge in quite a number of fasts. The New York City Board of Health now has under consideration eradiation equipment which sterilizes restaurant, hotel, and fountain equipment by lethal waves of light.

Already the death ray is beginning to take a place in commercial meat-packing and canning. Every day, microorganisms too small to be seen cause tremendous spoilage loss of foods. Therefore several commercial packers are beginning to use lethal light rays to sterilize and pre-insure the keeping qualities of their products. This attainment grew directly out of research on ways to sterilize refrigerators. The answer seems to be that foods should be made sterile before entering a refrigerator. Glass or earthenware containers can be pretty well sterilized with boiling water. Frequently containers made of wood, pulps, or plant-fiber products cannot stand the boiling water treatment and demand sterilization by eradiation.

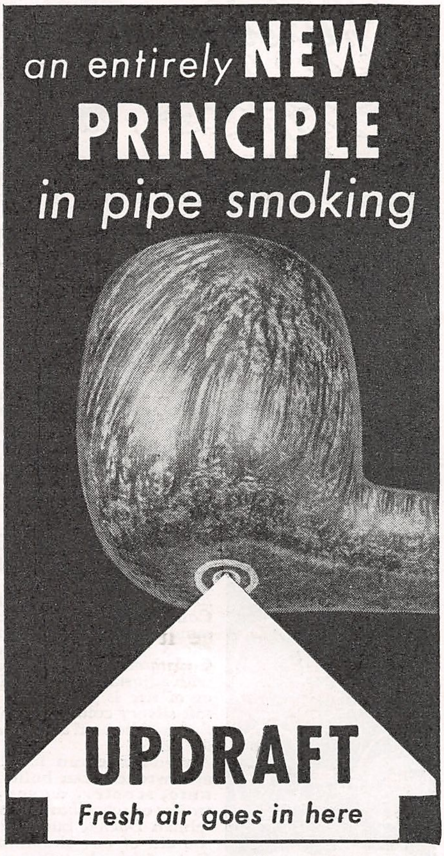
Molds, too, are among the most costly of all weed pests, ruining uncounted millions in food products every year. Mold ravages have been seriously aggravated by entry of the pre-sliced loaves of bread. Careful wrapping and storage are not always a safeguard. Sometimes mold spores get on mixing machinery or knife blades and become planted in the bread before it is wrapped. Today, at least one great chain bakery is beginning to use lethal-ray vaccination against molds in all of its products, including fruit cakes and plum puddings.

It is possible, even probable, that death-ray equipment will be available for home use within five years, or sooner. The equipment is still comparatively expensive, and if handled carelessly is extremely dangerous to human skin and eyesight. The inventors and developers make the friendly suggestion that if you wish to experiment with the lethal ray, you better watch your step.

So far we have been talking of extremely small light waves that destroy extremely small bugs. Let's consider larger waves that attract larger bugs. Use of lights for trapping night-flying beetles and moths gains increasing importance since we find that many of our gravest insect pests are readily attracted by lights which are within range of human visibility. On a summer night one may now see light traps in lawns and gardens, serving not only for the good of grass and gardens, but also for the comfort of people. Orchardists are learning that light traps are the most effective control of codling moths, foremost enemy to apples, and lawn tend-

(Continued to page 126A)

CARBURETOR
(Patent Pending)
KAYWOODIE

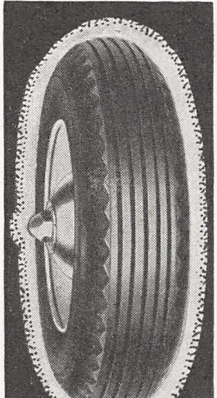


THE new **Carburetor Kaywoodie** has the following advantages:
a. *Its Perfect Mixture* (of Air and Smoke) improves the flavor, taste, and aroma — because the tobacco burns better.
b. *Its Perfect Mixture* (of Air and Smoke) keeps your bowl dry even with constant smoking.
c. *Its Perfect Mixture* (of Air and Smoke) keeps your smoke cool. Will not burn your tongue no matter how fast you smoke.
d. *Its Perfect Mixture* (of Air and Smoke) takes the rawness out of any tobacco.
This Updraft pipe is the result of 5 years of steady, intensive experimentation. Looks the same as the regular Kaywoodie, except that it has a "carburetor" hidden in the bottom of the bowl — it breathes at the bottom! It's mild enough for cigarette smokers! Examine it at your dealer's. It has the famous **Drinkless Attachment** in the stem.

KAUFMANN BROS. & BONDY, INC.
New York and London

DOENUT WHEELS AND BUILDING SETS MAKE

Excellent Christmas Gifts



Here is truly the finest gift in the world for any boy, any father, brother or friend. The new *patented* Musselman *Doenut* wheel is the greatest invention in the history of tiredom. Developed by the originator of the air wheel for airplanes. U. S. Patent No. 2015459. Single tube cord. Size 10"x2¾". Requires only 12 to 15 lbs. air pressure to carry loads up to *200 lbs.* per wheel. New cord angle construction with greater flexibility and longer life. Coasts more than *twice* as far as the ordinary tire and absorbs road bumps and surface obstructions more completely than any other tire built. *No jars or jolts.* Completely

ELIMINATES NEED OF SPRINGS

on any vehicle. Does not sink into sand, gravel, or soft ground. Completely *silent.* Handles the same loads with less than *half* the effort. Tire is mounted on a *Cadmium plated* steel disc wheel with adjustable ball bearings. Color of tire is jet black. Wheel a soft silvery color. A glorious gift that will be used and remembered for years.

Anyone who can handle a saw and wrench, can build a *midget auto, scooter, wagon, bicycle trailer* or *wheelbarrow* with Musselman *Doenut* building sets and the aid of our simple drawings. *Doenut* wheels are also ideal for building *hand trucks, carts, boat dollies, platform trucks, portable painting, spraying* or *greasing equipment* and for the parking leg of house trailers. We also offer factory built steel bicycle trailers. Send 25c for blue print drawings of any vehicle shown here and ask for free illustrated folder. Prompt shipments made on all orders.

MUSSELMAN PRODUCTS CO.

6247 St. Clair Ave.,
Cleveland, Ohio

YOUR NAME HERE

ers are finding that light is equally effective for trapping the Asiatic beetle which eats grass and foliage, while its larvae destroy roots.

The light trap is simple. It can be merely a lamp, either kerosene or electric, placed above a pan of kerosene or beside some leaves or strands of sticky flypaper. Moths and beetles fly to the light and eventually skid down into the kerosene or tumble against the flypaper. There also are light traps on the market.

Insect trapping with light becomes more important as insect damage becomes more serious. The world grows smaller as transportation becomes faster and bugs get around quicker. The Asiatic beetle, which probably accounts for the brown spots on your lawn, is said to have reached us by way of a shipment of oriental iris bulbs. This bug, one of the most serious menaces of our time, is one of the most easily trapped by light. An air liner from Cuba to Florida brings a dozen malarial mosquitoes as unnoticed stowaways. Left to their own devices many of our worst insect pests wouldn't spread far. But when the chance comes for an insect to hop a ride, that's a different story.

The real importance of light trapping of the night flyers lies in local control or defense against localized insect plagues and is an excellent supplement for quarantining, spraying and other forms of necessary warfare against our fiercest competitor, the bug. Light trapping came into popularity as a by-product of the nation-wide craze for miniature golf courses. People went at night to play on these brightly lighted courses. Lights drew bugs, and bugs annoyed customers. Operators demanded light traps and got them. Then it became evident that many of the bugs caught in these traps were ruiners of crops, lawns, and gardens.

To trap any sort of game, one must know something about the habits and senses of that game. Unquestionably insect eyes respond differently to light than ours do. To visualize just how the world looks to a bug is a hard job. But this is exactly what light engineers and entomologists, aided and coordinated by the department of agriculture, are trying to do. Progress is promising.

Many insects are attracted by light

waves which we can see. Asiatic beetles or codling moths can be trapped with an ordinary clear lamp. Others, like the mosquito, are actually repelled by lights that are within the range of human visibility. Others, like the grasshopper, evidently see by a light which we can't see at all. But within limits of our own sight and color spectrum, the greatest number of night-flying insects seem most attracted by bluish-white lights. Frequently a delicate blue bulb will lure twice as many bugs and moths to a trap as a plain clear bulb. Red lights have little drawing power since insect eyes seem blind to red and green. A red bulb will usually draw less than half as many as a clear bulb, while yellow or golden lights often repel. Bees, hornets, and wasps swarm about fine blue lights, and most other insects respond most easily to the fine blues and violets, which are the lower edge of the human spectrum. There is every reason to believe that ultraviolet light, ranging from colors faintly visible to the human eye, through the shorter wave lengths on down to 3,300 angstroms, the sun tan light, is most effective for drawing insects.

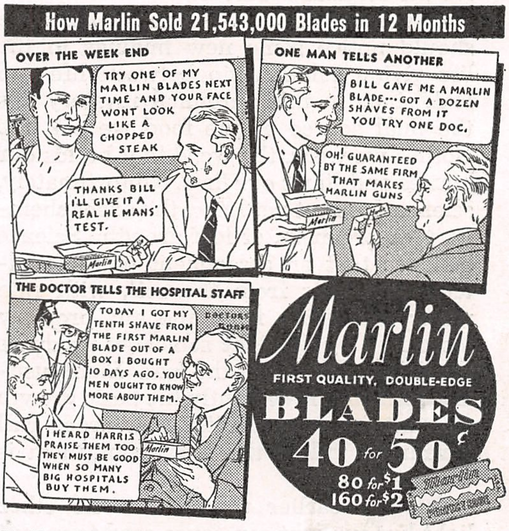
Colors and temperature reactions are also important. We don't know much about the thermodynamics of insect life, but we are learning something of color responses of the lower orders. In this connection the recent introduction of electrical illuminations through gases is important. Sunlight, as we know it, is a gas-filtered light, but the filtration provided by the atmosphere of the earth, and perhaps by oxygen clouds which surround the sun, allows a comparatively solid wall of color spectrum. On the other hand we now know certain gases can eliminate large portions of the color spectrum of light, blot out some colors entirely and therefore intensify others. The Neon tube light for signs is a good commercial demonstration of this principle. Light filtered through helium, for example, is cream-pink to the eye; through argon, vivid purple; through thallium, vivid green. Mercury vapor reduces the spectrum to red, yellow, green, blue.

Quite possibly this new conception of "gas light" may have a profound place in insect control through color response and allure. In any case light would seem the

(Continued to page 128A)

The Makers of
MARLIN GUNS
bring to you
this amazing true story

How Marlin Sold 21,543,000 Blades in 12 Months


OVER THE WEEK END
TRY ONE OF MY MARLIN BLADES NEXT TIME AND YOUR FACE WONT LOOK LIKE A CHOPPED STEAK
THANKS BILL I'LL GIVE IT A REAL HE MANS' TEST.
Marlin
ONE MAN TELLS ANOTHER
BILL GAVE ME A MARLIN BLADE... GOT A DOZEN SHAVES FROM IT YOU TRY ONE DOC.
OH! GUARANTEED BY THE SAME FIRM THAT MAKES MARLIN GUNS
Marlin
THE DOCTOR TELLS THE HOSPITAL STAFF
TODAY I GOT MY TENTH SHAVE FROM THE FIRST MARLIN BLADE OUT OF A BOX I BOUGHT 10 DAYS AGO. YOU MEN OUGHT TO KNOW MORE ABOUT THEM.
DOCTORS ROOM
I HEARD HARRIS PRAISE THEM TOO THEY MUST BE GOOD WHEN SO MANY BIG HOSPITALS BUY THEM.
Marlin
Marlin
FIRST QUALITY, DOUBLE-EDGE
BLADES
40 for 50¢
80 for $1
160 for $2
Marlin

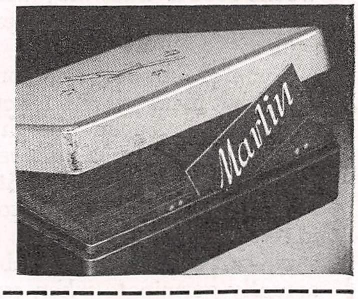
MARLIN revolutionized methods in marketing its razor blade at the sensationally low price of 1¼c each. Blades are no longer a specialty item; original patents have expired; they must now sell close to cost.

Instead of 3 or 5, Marlin packs 40, 80 and 160 blades in a box—wholesale quantities—and passes the savings on to you. Made from Swedish Surgical Steel. Money Back Guarantee. 400,000 users. If not available at your neighborhood store, order by mail.

Bakelite Christmas Gift Box with 160 blades Reg. $3 value $2

SEND NO MONEY

Pay the postman, plus 18c fee. Or, send stamps or check and save 18c fee.



MARLIN FIREARMS CO., Inc., 4512 Willow St., New Haven, Conn.

Please send me:
.....$2 Christmas Gift Box (160 blades)
.....$1 Regular Package (80 blades)
.....50c Regular Package (40 blades)

Amount Enclosed

NAME..
ADDRESS...
CITY...

See the Marlin Guns at your Dealer—Write for Catalog

(Continued from page 127A)

most logical control element for harmful insect and bacterial life. The field of light-trapping, like the infinite field of light study and experiment, is wide open for the amateur, for the home mechanic and for the original observer.

In viewing the new magic of light, we should notice some new findings in the life-giving relationship between life and leaf, since in this perennial mystery lies the final source of the food we eat, the clothes we wear, the wood that builds our houses and starts our fires. Unfortunately, science does not yet know the exact chemistry or organism of leaf growth. Science believes that an assortment of some fifteen chemicals from the soil, with rain water and gases from the air, properly motorized by sunlight somehow produces the delicate magic of the leaf. Light, usually sunshine, is evidently the basic growth element for most plants. Few seeds will germinate unless the soil about them is exposed to light.

But the earlier theory that no other light but sunlight can cause seed to sprout or leaves to grow is now being dropped. Some of the best nurserymen are finding that two hours of intense electrical lighting each day will produce excellent blossoms from virtually any variety of garden flower; that in greenhouses or indoors if sunlight be supplemented by electric lights at night, or even during part of the night, many plants bloom or mature several weeks sooner than they will in the open, even though soil and temperature are the same.

Some of our best agronomists now believe that plant growth is actually affected by moonlight, even though this is a reflected light that has long been considered a "dead" or "negative" light. Dr. Randall R. Kincaid, scientific director of the Florida State Experiment has found that a small-sized seed, such as tobacco seed, will actually germinate when exposed only to bright moonlight. Physically speaking, we can only say that light is light, and we have no very good reason to argue that sunlight is basically different from other light in its effect upon living organisms.

However, there is good reason to believe that colors and length of light wave have a profound bearing upon plant growth or death. Flint, a famous experimental botanist, finds that in terms of plant growth, yellow, orange, and red are the colors of life, while the part of the spectrum which we see as blue and violet are colors of death or dormancy to the leaf. That is, the coarser light waves are best for plants, whereas the finer waves, including the ultraviolet, don't help at all. This opens a tremendous field for thought and experiment.

Flint, assisted by Johnson of the Smithsonian Institution, also found a red that is poisonous to plants. This is a narrow band of coarse red just at the top edge of our visible color spectrum, and it is sure death to leaf and seed alike. Astronomers believe that the vast envelope of oxygen surrounding the sun, filters sunlight of this particular wave length. In their native state, plants are therefore not exposed to this coarse red. Develop a type of glass to accentuate or center this wave length, and unquestionably you have a tool of death to use against weeds or other plant pests. Or maybe a strong enough concentration of this coarse red could kill weed seeds already on or in the ground.

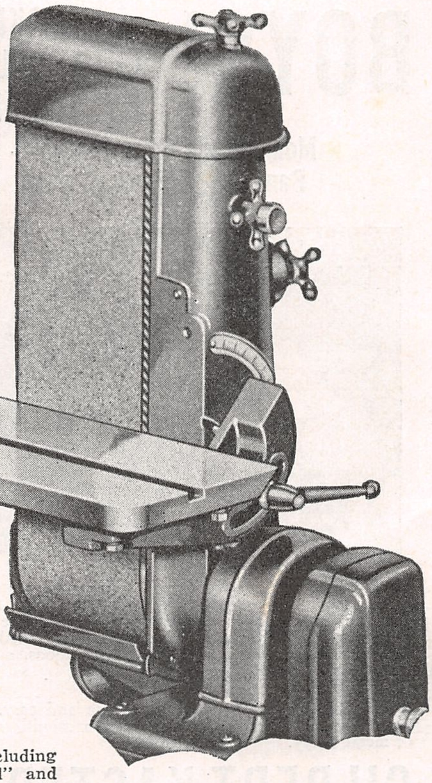
The same may be true of the plant poison contained in the blues and violets of our spectrum and in the ultraviolet rays. The Flint experiments prove that an oat sprout, growing heartily in ordinary unfiltered light, is definitely improved by yellow or golden rays, but when exposed to blue light, growth of the little plant ceases, its strength begins to fail, and presently it dies.

A famous French researcher, Le Clerc of the Paris Institute, goes further with this theory in analyzing the effect of Bordeaux mixture. Bordeaux mixture is a combination of copper sulphate and lime. For years it has been our greatest tool for fighting fungus diseases of plants. Fungi, tiny plants that suck the life out of larger plants, are one of the gravest menaces to plant life generally. We have been told that copper sulphate contained in the mixture poisons the fungus organism, and that the lime merely reduces the damage to the plant caused by the copper.

But Le Clerc proves that this cannot be poisonous to fungi because the copper is allied so tightly to the lime that it can never actually reach the parasite organ-

(Continued to page 132A)

WHY "DELTA" DESIGN MAKES BETTER TOOLS



Delta engineers have pioneered fundamental changes that have basically improved motor-driven tools. Men who use tools have been quick to recognize this. That's why Delta Tools are in use in tens of thousands of home shops, industrial plants, and schools all over the world. That's why Delta's best advertising comes from satisfied users. To illustrate, here are two out of scores of features that make "Delta" Tools better:

Double-sealed Ball Bearings

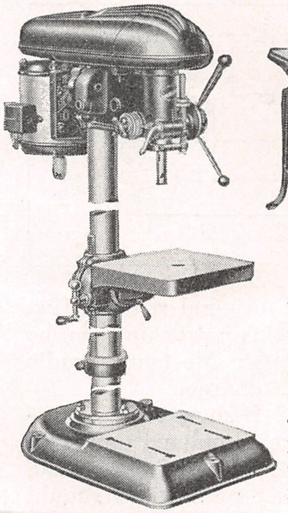
Delta uses only "double-sealed" ball bearings. The very finest type made. They are lubricated at the factory and need never be re-lubricated. They insure complete absence of bearing trouble, and require no attention during their entire life. Delta has pioneered the use of this type of bearing in "low-cost" tools.

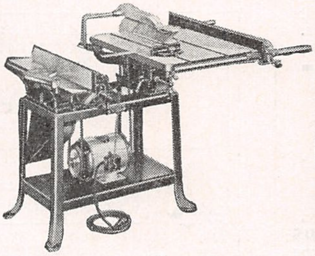
Complete Enclosure of Belt Sander

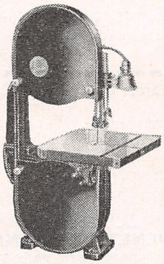
The New Delta Belt Sander is completely enclosed on all sides, leaving only the sanding surface exposed. This design has two great advantages: First: it gives the Sander the most complete guarding possible; Second: it permits the suction system to remove all the dust.

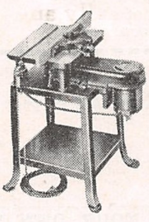
NEW BELT SANDER

The very last word in sanding machines. Has numerous new features including complete ball-bearing equipment with all ball bearings "double sealed" and lubricated for life of bearing, full 6-inch width of sanding surface. Operates in both vertical and horizontal positions. For complete details see new 1937 Delta Catalog.









The complete Delta line includes Drill Presses, Circular, Band, Scroll Saws, Lathes, Shapers, Sanders, Binders, and full line of accessories.

Send for 1937 CATALOG

It is crowded with interesting illustrations and descriptions of the complete Delta line. Points out in detail the important features of Delta design. And also the new 32-page book No. 3 of "Practical Delta Projects" crowded with new and "out of the ordinary" things to make—with many photographs, working drawings, and easy-to-understand illustrations. Simple, complete instructions make every project easy to follow. Every woodworker should have this book. Send 10c with coupon for Delta Project Book No. 3, 1937 Delta catalog mailed postpaid.

The new Delta 17-in. Drill Press is the greatest drill press value ever offered. The facts prove it. See Delta Catalog.

DELTA MFG. CO.

600-634 E. VIENNA AVE., MILWAUKEE, WIS.

IMPORTANT: Outside of the United States and its possessions, Delta Tools are known as "TAUCO" Tools. Tauco tools are identical in *every respect* to Delta Tools.

DELTA MANUFACTURING CO. **Dept. A 1236**
600-634 E. Vienna Ave., Milwaukee, Wis.

I enclose 10c (stamps or coin) for which please send me one copy of the new 1937 Book No. 3 of "Practical Delta Projects." Also place me on your mailing list to receive 1937 Delta catalog of quality motor-driven tools. I am interested in Delta Tools for:

☐ Home Shop ☐ Industrial Use ☐ School Shop

Name.. Age..........

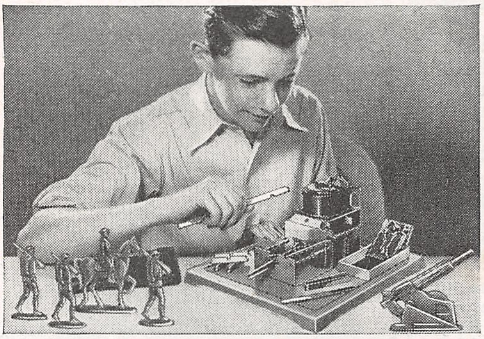
Address..

City.................................. State..............

( ) Check here if you are a Delta user now.

BOYS! MAKE LEAD SOLDIERS BY THE DOZEN

Mould Your Own Army — Band — Athletic Teams



With the new Gilbert Electric Kaster Kit, you can easily make a whole regiment of lead soldiers. Color them, too, with Kaster Kit paints, so they look just like the finest soldiers you can buy. Extra Kaster Kit moulds make football and baseball players, a military band, cannons, animals and other exciting models. Earn extra money by selling Kaster Kit models to your friends.

Kaster Kit operates by electricity. Safe and easy. See it at your nearest toy store. Complete with 1 mould and 24 pigs of metal $4.95.

GILBERT KASTER KIT

SEND FOR BIG FREE MAGAZINE—Tells you all about Kaster Kit. 36 pages of scientific news and exciting pictures. Free if you mail coupon at once.

The A. C. Gilbert Co., 651 Erector Square,
New Haven, Conn.
Send—free—your big, new 36 page magazine.

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City.. State....................

MAKE YOUR OWN VENETIAN BLINDS

Complete instruction book shows how easy you can make them in your own home shop. Postpaid only 25c. We furnish hardware, ladder-tape and cord at amazing direct-to-you low prices. Cost of book applied against hardware cost if purchased from us. Write To-day.

HESTON & ANDERSON 612 ELM STREET FAIRFIELD, IOWA

POWERlite HERE'S AMERICA'S FINEST ELECTRIC LANTERN

● 2 lights on a double acting switch. 800 ft. spot light from front reflector; broad floodlight from top,

80 to 100 Hours Light from One 6-Volt Dry Battery

The most powerful, serviceable electric lantern for all needs—fishing, camping, touring or home. Stands 6½ in. high. Unbreakable lens. At sport, hardware, electrical dealers, or write

DELTA ELECTRIC CO., Marion, Ind. Dept. 300

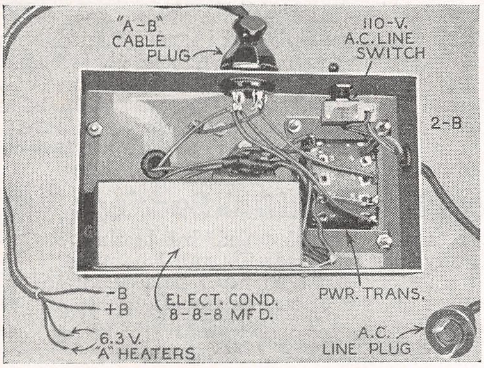
$3.35 (LESS BATTERY)

A GENUINE DELTA

"A-B" Power Unit for Sets

(Continued from page 900)

plified wiring diagram, showing all parts in their relative positions above and below the base, is given in Fig. 2. It will be noted that the terminals of the power transformer are numbered and the same numbers appear in the schematic diagram Fig. 3, to indicate the various primary and secondary connections. A 5-volt secondary winding, for the type-80 rectifier tube, is indicated at 1 and 3; terminals 5 and 9 are the plate-winding leads, 7 indicating the center tap. An original material list of all parts used in this power unit can be obtained from Popular Mechanics radio department, without charge.



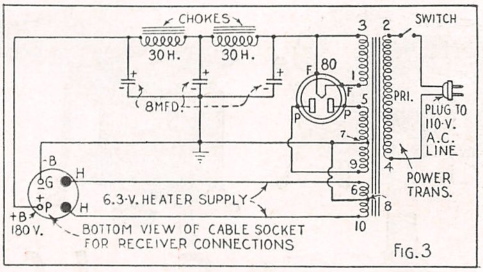


Fig. 3

Photos 2-A and 2-B show top and underside views of the completed unit with the various connections clearly indicated. The cable for the set connections should be 4 or 5 ft. long so that the power unit can be kept some distance from the receiver. This is important when it is to be used with a short-wave set. If the builder wishes to make a semi-permanent installation, the terminals may be connected to another plug that will fit into a cable socket mounted in the chassis.

RADIO'S GREATEST VALUES!

In Your Allied Catalog

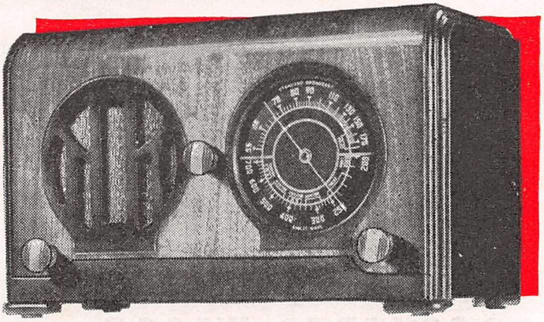
SENSATIONAL 1937 *Knight* RADIOS

WITH EXCLUSIVE MAGNA-SPAN DIALS AND VITA-TONE SPEAKERS

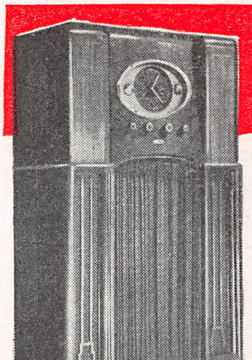
AS LOW AS $8.45 - 5-19 TUBES

38 Models to Choose From

America's most amazing radios! The latest developments in radio—new Giant Magna-Span Dials, perfected metal tubes, Flywheel Tuner, mighty "Vita-Tone" super-dynamic speakers, "Electric Eye," Visual-Wave Band Indicator, etc. Tone quality, sensitivity, selectivity, volume capacity, all-around performance again prove that only ALLIED is able to offer such tremendous values. All-Wave, Dual-Wave and Short-Wave—5 to 19 tubes—AC, AC-DC, 6-volt, 32-volt, battery and auto sets—a set for every purse and purpose.

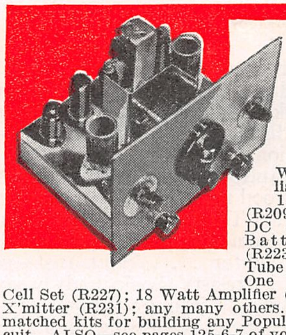


An amazing 5 Tube Dual-Wave Value—actually achieves 8-tube efficiency! Sensationally low-priced. Tunes 2 Full Bands—43-150 meters for Short Wave, police, aviation, amateur 'phone—also Foreign 49-meter Reception; second Band 175-550 meters—upper police channel and standard Broadcasts. Latest RCA licensed circuit—rubber-floated tuning condenser; 8 tuned circuits, Automatic Volume Control. Big 5½" Vernier dial makes tuning easy and accurate. Full size 6" Electro-dynamic speaker reproduces with flawless fidelity. Beautiful "Lay-Down" cabinet. 1937's **Radio Sensation**—see Back Cover of ALLIED'S Free Catalog.



1937'S WONDER RADIO *Knight* 19 TUBES MASTERBILT A.C. SUPERHET

Tunes the World! 3 full bands cover **everything broadcast!** Amazing new circuit—Dual Dreadnaught chassis (2 chassis)—Giant 30-Watt output, handled with remarkable tonal beauty by two 12" Vita-Tone speakers. 11" Magna-Span Dial with five exclusive features: The "Electric Eye," Flywheel Tuning, Wave Band Indicator, "Tell-Time" Scale, 340 deg. concentric calibration. America's First Luxury Radio at a popular price! For full description, see pages 12-13 of ALLIED'S Free Catalog.



FREE! Parts Lists For Radio Builders

Write for Free parts lists covering P. M. 1 Tube Portable (R209); 2 Tube AC-DC (R211); 4 Tube Battery Portable (R223); Beginners' 3 Tube All-Wave (R224); One Tube Flashlight Cell Set (R227); 18 Watt Amplifier (R230); 150 Watt X'mitter (R231); any many others. We can supply matched kits for building any Popular Mechanics circuit. ALSO—see pages 125-6-7 of your ALLIED Catalog for other new, low-priced Build-Your-Own kits.

EVERYTHING IN RADIO AT LOWEST PRICES!

You need **ALLIED'S Free Catalog,** whether you sell, service or build radios, install P. A. Systems or operate a "ham" station. It shows **Everything** in Radio. Besides amazing new Knight Radios, its 152 pages include over 10,000 exact duplicate and replacement radio parts. Test Equipment, latest Public Address Equipment for every Sound need, Amateur Transmitting and Receiving gear, dozens of new build-your-own kits, Rurlpower units and Windchargers, etc.

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Catalog
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CORPORATION

Faster Service—Lower Prices—Highest Quality

We buy in vast quantities, get lower prices, and sell for less, passing the resulting savings on to you. Our complete stocks are located under one great roof—central location for faster shipping; and real, personal service. Every item tested and approved by ALLIED expert engineers. See all these great radio values in the new 1937 ALLIED Catalog. If you don't have a copy, send coupon now!

ALLIED RADIO

833 W. JACKSON BLVD. CHICAGO ILL.

Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill. Dept. 5-M.

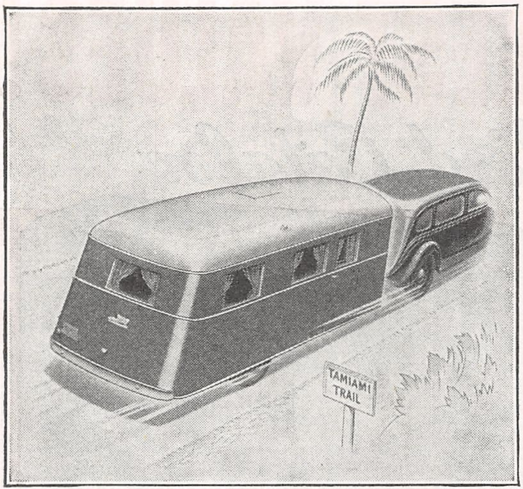
☐ Rush me a Free copy of your 152-page 1937 Catalog showing the 38 new Knight sets and complete Radio Supplies.

☐ Send me Free Parts List for Kit No..............

Name..

Address..

City...............................State..........



COVERED WAGON

Introduces . . .

SHERMANITE STEEL COACHES FOR 1937

Covered Wagon, with its new 1937 trailer homes, presents the all steel chassis and Shermanite steel body—two features that will revolutionize every previous standard of trailer construction—provide husky, rugged dependability coupled with a light weight factor that defies duplication.

Shermanite Steel is a laminated steel and plywood material inseparably joined together. This material is actually stronger than automobile body steel . . . is 50% lighter . . . can't rust—can't buckle . . . resists shock, body weaving and strain . . . is more dent-proof than any other metal possessing similar lightness.

Don't fail to see these new all-steel sheathed Covered Wagons on display *at every important* AUTOMOBILE SHOW from New York to Los Angeles. On display November 15th at your nearest Covered Wagon Dealer.

Don't miss seeing the latest and greatest Covered Wagon, $395 and up f. o. b. Mt. Clemens, Mich. *Or write the factory direct for new literature.*

New C. I. T. Time Payment Plan

COVERED WAGON COMPANY

482 Cass Avenue, Mt. Clemens, Michigan

COVERED WAGON

TRAILER HOMES

The Miracles of Light

(Continued from page 128A)

ism. He also proves that the leaf coating of the copper sulphate-and-lime compound called Bordeaux mixture allows only blue light to reach the fungus organism, since the lime filters out all the rest of the spectrum. Neither mildew spores nor fungi mycelium can grow under the poisonous blue ray. The fungus spores can germinate, but the blue light weakens them and they soon die.

All this opens an entirely new concept of plant-disease control, weed killing, speedy propagation of flowers and vegetables based upon the application and filtration of light, and upon light bands and death bands of the color spectrum.

Since sunlight is free, and of worldwide extent, since electrical facilities increase at an unprecedented rate, the possibility of man's being able to control or influence plant life by means of light is of great importance and timeliness. We still don't know exactly what light is. But we are learning a great deal more about what light can do.

Hitch Your Wagon to a Car

(Continued from Coloroto Section)

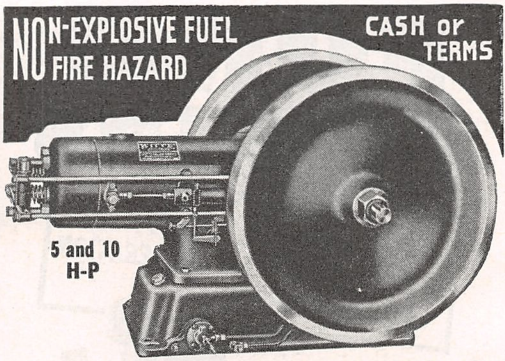
lapse, or fit into something else. And it is surprising how many comforts and conveniences can thus be stowed in a space hardly as large as a kitchenette. Divans do double duty as beds, stoves fold out of sight, tables disappear into walls and every inch of cupboard and storage space is utilized to advantage.

Most factory-made trailers have a foundation frame of tubular steel and angle iron, or a combination of steel and spruce, to which the springs are attached. Spruce may be employed for the skeletal structure while plywood, tempered Masonite or some similar substance forms the walls, roof and interior. An outer covering of waterproof leatherette improves the appearance and protects the wood from the weather.

Proper balancing is important, particularly for the two-wheelers where the hub or axle is a fulcrum above which the trailer pivots. An axle placed in the center of a fourteen-footer leaves an over-

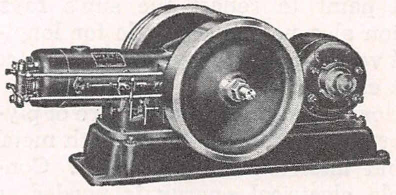
(Continued to page 134A)

WITTE DIESEL ENGINES



The unbelievable economy of the small Diesel has revolutionized power costs. With a Diesel, power bills are only a fraction of their former size. Where power is used 800 hours or more a year install a WITTE Diesel Engine **and it will soon pay for itself.**

EFFICIENCY UP---POWER COSTS DOWN

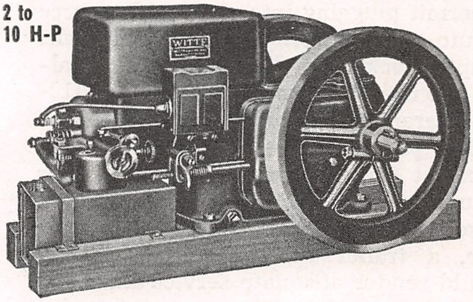


DIESEL LIGHT PLANTS

Light and power users save 50% and up with a WITTE Diesel Light Plant. No peak load or stand-by charges. Current produced for less than 1c per kilowatt. Money saved every hour of operation. Alternating or Direct Current.

The WITTE Diesel has the same important features and operating characteristics of the most modern large Diesels, and brings to the small power user the same startling economy and dependability. Fuel consumption is less than one-half pint of non-explosive fuel per hour per horse-power.

Thoroughly modern in every respect, the WITTE incorporates every worth-while advance in Diesel Engine design. Built of the finest materials ever embodied in Diesel Engine construction. Switch to WITTE Diesel power and **save your money.** Easy terms to responsible parties—immediate delivery.



WITTE GASOLINE ENGINES

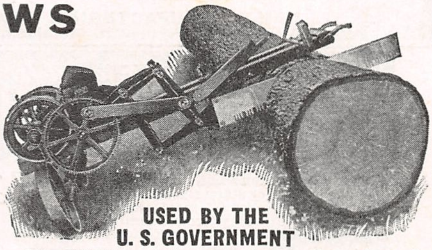
TYPE "J" ON WOOD SKIDS

Where the amount of power used does not warrant a Diesel Engine our Type "J" on wood skids or Type "K" on iron base is recommended. They are Enclosed, Self Oiling and have Timken Roller Bearings. Operate on gas, gasoline, kerosene or distillate. Lubrication is automatic. Run smooth as an electric motor. Consume less oil and fuel and deliver more power. Pronounced by experts years ahead in design and construction. Buy your power equipment from a power specialist. Try a WITTE and profit.

WITTE LOG AND TREE SAWS

"Saws 'em down and cuts 'em up." There is money for you to make with a WITTE, timber to be cleared, logs to be cut, wood supplied for fuel. WITTE outfits have safety lever clutch control, saw guide, automatic force feed, human arm swing and other exclusive features. Portable as a wheelbarrow. Engine may be belted to other power for year around use. Buy from a reputable firm.

FREE CATALOG—CASH or TERMS—QUICK DELIVERY


USED BY THE U. S. GOVERNMENT

The WITTE cuts logs into fire wood, cord wood, fence posts, cross ties and shingle butt lengths. It is the best sawing outfit ever built. There is no other saw like it.

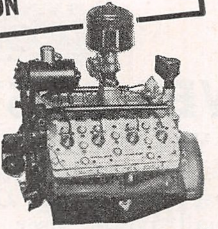
215-L So. 2nd St.
HARRISBURG, PA.

WITTE ENGINE WORKS

1749 Oakland Avenue
KANSAS CITY, MO.

FORD OWNERS

17% to 27% MORE POWER
10% to 19% FUEL SAVING
5% to 14% FASTER ACCELERATION
66% LESS CARBON



FOR ALL 1935-36 FORD V-8 ENGINES WITH NEW THERMO-FLOW POWER HEADS

After several years' research, our technical staff has perfected the application of a new copper alloy which, when cast into a cylinder head, gives remarkable performance improvements on modern automotive engines. On actual road use, a fleet operator of Fords reported 19% fuel saving with the new Thermo-Flow power head; and drivers said it was finest performer in their experience! Ideal for Ford V-8 trucks, buses, cars, in police, fire and ambulance service.

CHRIS-CRAFT supplies Thermo-Flow power heads on certain marine engine models. Owners report exceptional performance.

JOHNSON Sea Horse racing outboard motors Class A and B are equipped with Thermo-Flow heads.

FORD MARINE conversions, supplied by leading marine engine companies, including Kermath, Lehman, Osco, Roberts, and Scripps, offer Thermo-Flow power head as optional and replacement equipment. See it at your marine engine dealer's, or write direct!

GET FREE BULLETIN!

We will send you free an engineer's report and results of actual road tests showing unusual performance improvements with new Thermo-Flow power head. Write for it today!

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While they last. SWELL NEW COMIC MAGAZINE — 32 pages. Joe Palooka, Buck Rogers—lots of others. Tim McCoy portrait. Limited supply. HURRY! SEND NO MONEY. Mail your name, address and age on a penny postcard to

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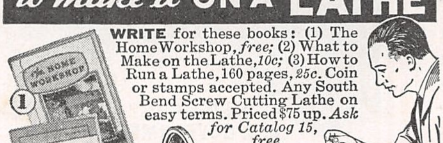
710 Union St., Plymouth, Michigan, U. S. A.

WHAT TO MAKE *and how to make it* ON A LATHE

WRITE for these books: (1) The Home Workshop, *free;* (2) What to Make on the Lathe, *10c;* (3) How to Run a Lathe, 160 pages, *25c.* Coin or stamps accepted. Any South Bend Screw Cutting Lathe on easy terms. Priced $75 up. *Ask for Catalog 15, free.*



SOUTH BEND LATHE WORKS
379 Madison St., South Bend, Indiana, U.S.A.

(Continued from page 132A)

hang of seven feet which is likely to prove troublesome on rough roads because of the teetering action. Aside from scientific mounting, ease of towing also is dependent on correct hitching. Railroad type couplings, tension-spring hitches and various types of swivel couplings as well as special wheel, spring and axle assemblies have been designed to keep the trailer "tracking" and prevent swaying.

Most well-constructed trailer bodies now are insulated against heat and cold by a dead air space between outer and inner surfaces, or by employing heavy insulating foil and silvering roofs with aluminum paint to reflect the sun's rays. Provision also usually is made for longitudinal ventilation to dispel the heat, once it finds entrance.

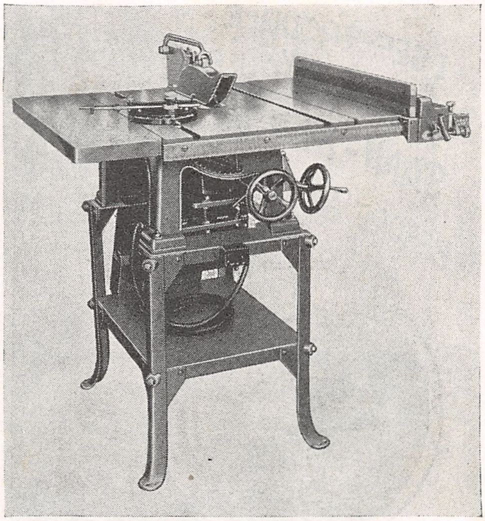
Interior wall surfaces usually are of plywood or some similar material with metal trim and linoleum-covered floors. Considerable electrical energy is needed to operate fans, lights, a radio and other trailer conveniences. Often the ordinary car battery is unequal to the task, so some of the more elaborate units are equipped with a generator driven by a one-cylinder gasoline engine. In other units, a 110-volt circuit with an external outlet is provided to permit plugging into an outside source at auto camps where current is available. Adapter sockets for lights are used to allow the use of six-volt lamps where 110-volt current is unavailable although some trailers have separate light circuits.

Except for tire replacement, there is virtually nothing to wear out in one of these modern trailers. With reasonable care, a trailer coach purchased today should render adequate service for many years and represent as permanent an investment as, for instance, a summer cottage. As a matter of fact, thousands of families have found these rolling homes offer all the advantages of summer cottages—plus mobility—something no summer home ever possessed before.

(Concluded next month)

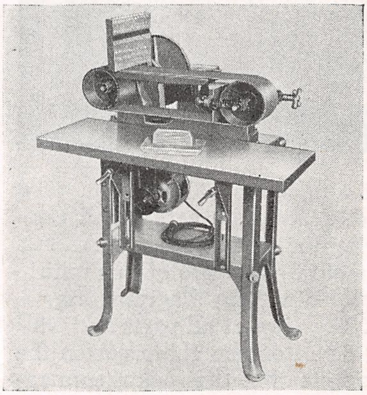
¶Popular Mechanics Magazine does not publish the name of the maker of, or dealer in, any device described in its pages, but this information will be furnished by our Bureau of Information upon request, accompanied by stamped envelope.

ENGINEERED POWER TOOLS
For The Needs Of Every Shop In The
1937 DRIVER LINE!



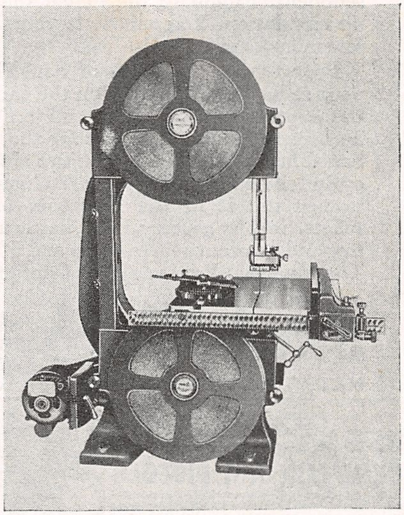
NEW! 10" TILTING ARBOR SAW

The tilting blade makes this saw ideal for angular cuts in unwieldy stock. The massive, rigid frame and heavy tilting unit assure extreme accuracy, though the arbor tilts easily—almost without effort. With the full horsepower motor, it zips easily through hardwood 3¼" thick—greatest capacity ever offered in this price class. Heavy duty preloaded SKF bearings. Table 35" x 26" with 13" in front of the 10" blade. The Driver 10" Tilting Arbor Saw is one of the most powerful and substantial saws ever offered to craftsmen.



NEW! 3-IN-1 UNIVERSAL SURFACER

(Series 700) Think of the many uses in your shop for a tool that will do belt sanding, disc sanding, and also "stroke" surfacing—three features never before combined in an engineered surfacer at anything like the low price at which this machine is offered! Surfaces panels up to 13" wide under the belt. Belt 4" wide. 18" between pulley centers. 10" disc with tilting table and mitre gauge. Also manufactured in the 900 series, with dust collecting system, rolling table under belt and many other quality features.



NEW! 16" BAND SAW

Here are the vital features Driver engineers built into this new tool: true cutting, vibrationless operation, full protection for operator, reliability. Too, they engineered fine appearance and graceful lines into this machine. Its cutting capacity is 12", throat 16". One piece frame. 18" x 17" table tilts to 45°, with calibrated quadrant. SKF Ball Bearings. No section of blade exposed while sawing.

DRIVER builds three full lines of Engineered Bench Saws, Band Saws, Jig Saws, Jointers, Drill Presses, Lathes, Flexible Shafts, and Motor Grinders. Walker-Turner Co., Inc., 1126 South Ave., Plainfield, N. J.

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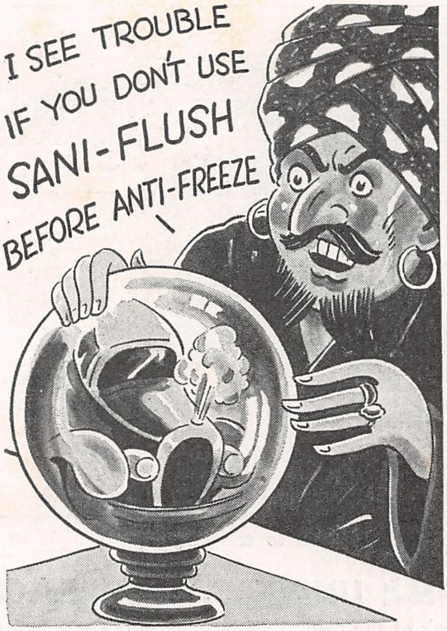
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Pour ten cents' worth of Sani-Flush in your radiator. (Directions on the can.) Run the motor. Drain. Flush and refill with anti-freeze. Then you're set for the winter. Sani-Flush is safe. Cannot injure aluminum cylinder head, radiator or fittings. Most women use it in the bathroom to clean toilets. Sold by grocery, drug, hardware, and five-and-ten-cent stores—25c and 10c sizes. The Hygienic Products Co., Canton, Ohio.

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NEW

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GIVEN! $6 Double-blade Paddle now given with your Ki-Yak — if you hurry!

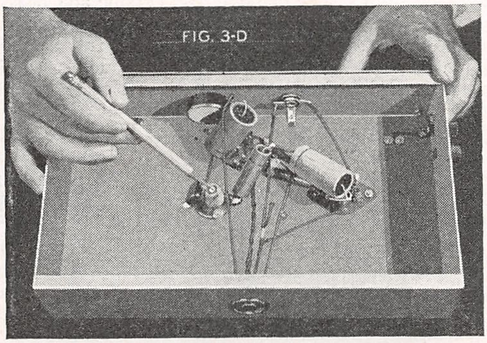
Beginner's S-W Two-Tube Set

(Continued from page 899)

chassis base and panel with 6-32 machine screws and nuts. For connections to the A and B-batteries, a socket is mounted in the rear of the base for a 5-prong connector plug. This arrangement also does away with the necessity for a double-pole switch to disconnect the batteries when the set is not in use.

Fig. 2 shows the schematic circuit diagram with bottom views of the tube and plug-socket connections, also a front view of coil selector unit, the actual coil connections being indicated in Fig. 2-A. Fig. 3-A shows a close-up photo of this unit.

FIG. 3-D



The simplified wiring diagram, Fig. 3, shows an X-ray view of all parts and wiring looking down on the chassis from the rear; please note that the socket connections are top view in this diagram. The antenna-trimming condenser C_1 is a completely insulated type mounted directly on the metal base by means of a bracket. The knob is at the rear; once adjusted for your particular antenna to obtain the loudest signal, it may be left alone. Figs. 3-B, 3-C and 3-D show clearly the actual arrangement of all parts. An original material list of all parts used, is available from Popular Mechanics radio department without charge. The blueprint number is R-232.

A fairly long outside antenna will give the best results; no ground connection is required. However, if a B-eliminator is used it is a good idea to connect common B-negative to ground preferably through an .02 mfd., or larger, 400-volt fixed condenser. Tune in signals in the regular manner, using the screen potentiometer for controlling regeneration.

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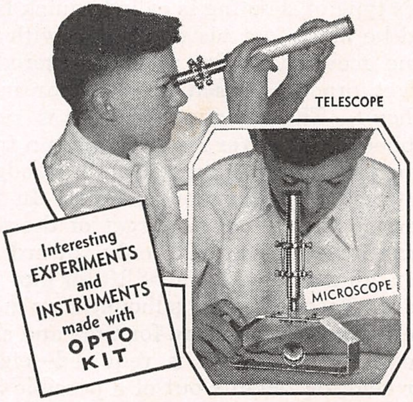
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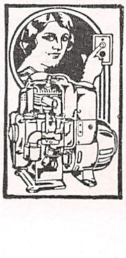

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Adjustable peep sight

NO CLEANING
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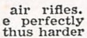
Grooves inside barrel make the Crosman a real rifle with all the hair-splitting accuracy this term implies. Shoots bullet (pell) same diameter as .22 powder rifle, but silently, powerfully, with no recoil, using the terrific force of compressed air—same force U. S. Navy uses to drive 2000 lb. torpedoes. Marvelous for target, small game. Single and 20 shot repeater models. No license required.

SuperPells



Best for all .22 cal. air rifles. Heavier, longer, more perfectly formed (secret process), thus harder hitting and more accurate. Made to American standards by American workmen. Write for folder.

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Containing important target and game shooting facts; also Crosman Catalog. Write. **Ask Your Dealer to Show You a Crosman.**

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T-Men of the Treasury

(Continued from page 837)

having to make seventy per cent of the total, he must make eighty per cent.

Next the trainee is furnished with the silhouette target of the body of a man. This type of shooting is called "quick fire" and he must "get his man," and with the same accuracy of fire as he registered in target practice. Such firing is far more difficult. The silhouette target is on a bobber and the firer must lift his gun from a forty-five degree angle from his body to a straight arm position and fire. In this practice the silhouette target of the man turns for three seconds only toward the firer. In that time he must lift his gun and shoot. To qualify for silhouette or quick fire the same high score for time and slow fire at fifteen yards is required—eighty per cent, or 240 hits out of a possible 300.

Next the trainee is advanced to the .38 and .45 caliber class. Here the going is tougher than ever. For the guns are kickers. They must show the same proficiency with these heavier guns as with the lighter types. In the end the men qualify as marksmen, sharpshooters or experts. These degrees are based on scores made. To qualify as a marksman a trainee must be able to score 210 out of a possible 300 points. To become a sharpshooter he must score 270 or better out of a possible 300.

Although a marksman is the lowest rating given a trainee, he can hit a man at fifty yards. However, scores of 290 are not uncommon among the T-men personnel. This rates with the best shots in the nation. These deadly shots of Uncle Sam do not stop with revolver training. The T-men receive training also in the use of Thompson sub-machine guns, sawed-off shotguns, gas grenades, and tear-gas billies. The trigger men are instructed how to hold the grenades and how to throw them with accuracy, so they will "gas" the enemy instead of themselves. The gas accessories, incidentally, can be thrown through the windows of a house without danger of burning down the structure.

Today the T-men throughout the nation are burning up ammunition to the tune of 4,000,000 rounds annually of .22 caliber—and 500,000 rounds of .38 and .45 caliber and the nation's treasury and its borders are being guarded as never before.

Utopia in the Tall Timbers

(Continued from page 863)

a trowel, he is privileged to build his own and take credit for time expended. Build-your-owners have made themselves homes for a cash outlay of $100 or less.

Nature has delivered the materials—timber and stone—on the site. It's a poor building lot, indeed, that doesn't assay sufficient cobble stones or lava chunks or granite blocks to build a forest cabin or mansion. If preference runs to logs, standing timber may be purchased from the government in certain districts.

The $500 building restriction was fixed to discourage the construction of unsightly shacks. Buildings must harmonize with surroundings; must be kept painted or stained and in good repair; premises free from rubbish or fire hazards; smoking confined to a lessee's own lot or to restricted districts. Sites are available to any one who is on good terms with the law.

Lots range from one-quarter to one-half acre, and only one residence is permitted to a single lot. Garages and other accessory buildings are sanctioned. A lessee may sell or remove his improvements at will or transfer his lease.

National forest homes must be occupied by the lessee or his family at least fifteen days a year. That doesn't mean consecutive days. Hundreds use their cabins only for week-end parties or as fishing and hunting lodges. Leases are obtained by application to the supervisor of the forest in which a lot is desired, the applicant selecting his own site. He must furnish specifications of his building plans to the supervisor, and must complete his home within two years after leasing.

Originally, national forest homes were intended only as summer recreational spots. Within the last four years they have become increasingly popular as permanent residences. Particularly is this true nearer the coast, where mild climate prevails the year round, and where snow seldom interferes with traffic.

Many of the tracts have water systems, electricity and telephone connections. Fuel is free to the man who isn't too busy or too lazy to chop his own. There are national forest homes that cost up to $35,000; others that were built for $100 cash and $400 labor. Take your choice.

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TOOL OF 1001 USES

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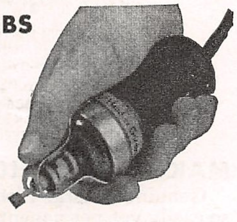
A WHOLE SHOP FULL OF TOOLS IN ONE

GRINDS, CUTS, DRILLS, POLISHES, CARVES, SAWS, SANDS and ENGRAVES

Craftsmen and mechanics everywhere are enthusiastic about its marvelous performance. Wrenchless chuck enables you to change instantly any one of 200 different available accessories. Plugs into any electric socket, 110 volts, AC or DC.

FASTER, BETTER JOBS

Standard Model in its 6th successful year. Saves hours of tedious work. For use at home, in shop or take to job. Pays for itself many times over. Weighs only 1 pound, 13,000 r.p.m.



$10.75 and up Postpaid U. S. A. 3 Accessories FREE

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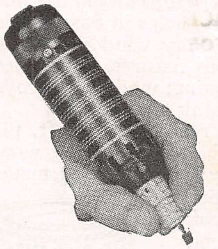

For constant service—nothing else like this easy-to-handle production tool for making, shaping, polishing metal products, alloys, glass, composition materials, wood, stone, etc. Tests show it to be the fastest, most powerful tool for its type and weight, 12 oz., 25,000 r.p.m.

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Old Screw Holes
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WOOD in cans

Force Plastic Wood into old screw holes, even off; when dry, paint or varnish will completely hide the holes. Hinges can be replaced in the same holes after plugging with Genuine Plastic Wood.

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Genuine Plastic Wood makes household repairs so easily yet permanently—use it to fill old nail and screw holes; broken furniture, holes in baseboards, floors, cracks in shelving, leaky window frames, boat repairs; reset bathroom fixtures, loose tiles, holes around pipes, under paint; modeling decoys, fishing lures, cover countersunk screws, etc.

Genuine Plastic Wood is real wood in soft, pliable form—when dry it is hard, permanent wood that adheres to any clean, dry surface—wood, metal, stone or porcelain. Genuine Plastic Wood is waterproof, weatherproof and greaseproof.

Get your can or tube of Genuine Plastic Wood for few cents at paint or hardware stores.

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Gillette Blades
5 for 25¢ · 10 *for* 49¢

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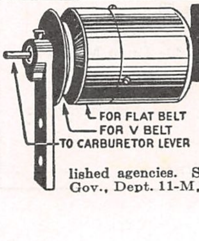


To control speed of any make of auto or truck engine, regardless of load changes, when used as a stationary or portable power plant. Fully guaranteed. No cash down. Governor speed range from 400 to 3000 R.P.M. Fine opportunity for established agencies. Send for free circulars. Mfrs. Candee-Smith Gov., Dept. 11-M, 215 No. L. A. St., Los Angeles, California.

The Dare-Devil Fleet

(Continued from page 831)

out if you are on the deck of a tow boat. And also, you better stay clear of the discharge water that spurts from the greyhound's auxiliaries and condensers. It is strong enough to bowl you over.

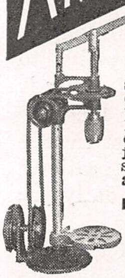
To dock the "Normandie" or "Queen Mary" with dispatch, the tugboats maneuver in squads. They do "squads right" and "squads left," or execute "to the rear—march!" with military precision. Under full power they nose against the bow, or they pull on a hawser. The water is churned frothing white as they fight with bulldog tenacity against the tide. Assisted by her propellers, the ship swings slowly and points her bow into the slip. The berth is so narrow for a 1,000-foot vessel that it is often necessary to use the corner of one pier as a pivot for swinging her bulk until she is at right angles to the tide.

The supreme skill of the tugboat captain on the bridge comes when he has to judge the clearance for the great bow. The "Queen Mary" has been squeezed into her slip with less than two feet of clearance. What terrible disaster would occur if those fighting tugs suddenly backed off and left the ship to the mercy of the tide? One accident like that would not only ruin all the tugboat captains involved, but would seriously damage the reputation of the tugboat company. It takes years of hard, patient work to build up a flourishing tugboat business but one error of judgment on the part of a tugboat captain can bring disaster to his company.

Tugboat companies have their specialties. Some confine their activities to towing barges and lighters. Others go in for long-distance hauling. Still others do passenger ship work. A few large companies are prepared to handle almost any job, and will send tugs anywhere. There are special tugs for salvage work, and others for heavy sea duty. Such, for instance, is the 344-ton monster tug "Susan A. Moran," one of the most powerful in the world. She can go to sea in the roughest weather, and she can tow thousands of tons. It cost $250,000 to build this seadog to order. Although her speed is thirteen knots, she is too large and clumsy for steamship docking.

(Continued to page 142A)

AMAZING VALUES IN . . . POWER TOOLS



Oh man, what buys these are! Every one a solidly built, practical tool. Most any small electric motor supplies sufficient power. Marvelous Xmas gifts. Here are the specifications: **Drill Press:** 15" high, drill table 3" in diam.; drilling to center of 4" circle. Table fully adjustable. Ball thrust bearing for long wear. The slickest ever for quick, accurate drilling.

DRILL PRESS

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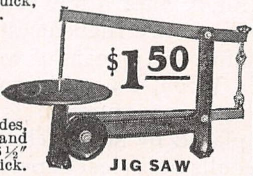


$1.50

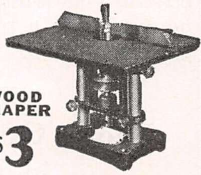
Jig Saw: Includes 12 assorted blades, blade adapters, roller saw guide and manual. 15" long, 8" high, 6½" table. Cuts wood up to 2" thick.

JIG SAW

Circular Saw: 4" combination rip and crosscut blade. Oil-less bearings. 8" x 5¾" steel table adjustable so that by turning stock, pieces up to 2" thick may be cut. Adjustable ripping fence. Saves hours of hand sawing.

$3

CIRCULAR SAW



Shaper: Uses standard 5/16" cutters (cutters 55c extra). Height, 5⅜". Table 8" x 5¾". Spindle and Guide adjustable without tools. Oil-less bearings. You'll say it's the biggest power tool value in the U.S.A.

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FREE! *5 endless rubber belts worth $1.25 with every order for all 4 tools! Order now for Xmas delivery. Add 25c for C.O.D. or outside U. S. A. shipment. Order Now or Write for Free Catalog Showing Full Line.*

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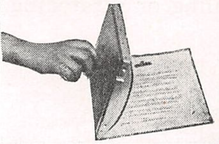

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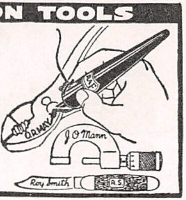

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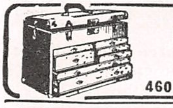

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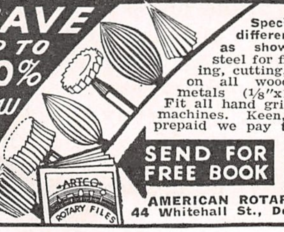

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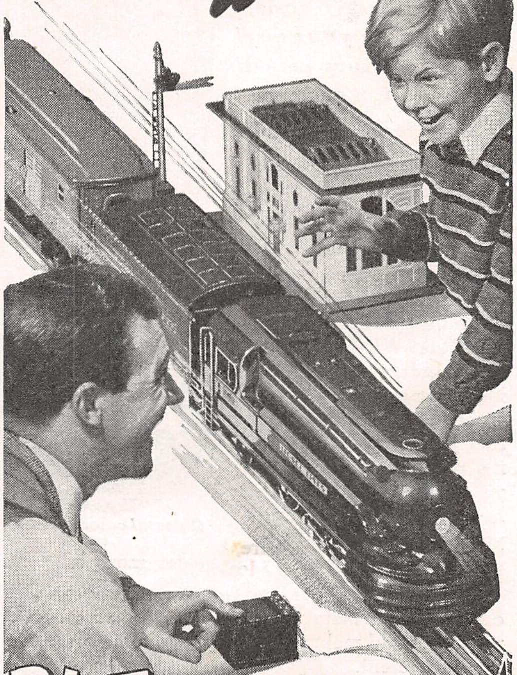
RACING, REVERSING, SWITCHING —BY REMOTE CONTROL

Thrilling to Watch



BUT— JUST WAIT 'TILL YOU *HEAR* THEM!

Railroad whistles from miniature trains so real you'll think they are the echo of a passing Express. Long and loud or short and sharp, whether the train is racing ahead, reversing or standing still—and all at the touch of a magic button. The whistle is built right into the train itself—into the greatest fleet of streamliners Lionel has ever produced. Send for the new, 1936 Lionel Catalog that tells you all about them. Just enclose 10c in stamps to cover the cost of postage and handling.

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The Lionel Corporation, Dept. O
15 East 26th Street
New York, N. Y.

Please rush me a copy of the new, 1936 Lionel Catalog. Enclosed is 10c in stamps to cover the cost of postage and handling.

Name______________________________
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Now! **A Great New**

PINES WINTERFRONT

at an amazing low price!

- *More heat from heater!*
- *Makes starting easier!*
- *Beautifies your car!*
Reduces warm-up period!
- *It's metal, it's durable!*
- *Protects cooling system!*

NOW give your car the best winter protection—at a cost of less than one freeze-up!

Yes—this winter you can protect your car with a genuine PINES Custom Bilt Metal WINTERFRONT for as little as $4.95! This beautiful accessory is designed to look like an original part of your car and it's practical, too! Keeps your engine at summer heat all winter long. Ends your fear of a frozen motor while driving. Makes your heater more efficient.

$4.95 FOR FORD CHEVROLET PLYMOUTH

$5.95 FOR DODGE OLDSMOBILE

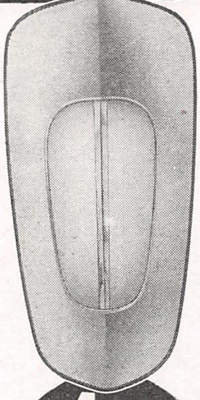
(Special colors extra)

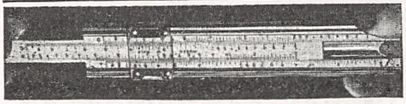
Remember, neither anti-freeze nor a thermostat can keep your motor *warm*. You have to cover your radiator—and makeshift covers are both unsightly and inefficient.

Don't wait! Get a Pines Winterfront now! Takes just a minute to install. Works like a charm. It will more than pay for itself during the first cold wave.

Patents applied for

PINES WINTERFRONT COMPANY
1135 Cicero Avenue, Chicago





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With A-B-C-D Scales. Multiplies, divides, squares, takes square root, finds circumference and area of circles. 6 inches long—thin construction. NO WOOD OR CELLULOID. Fits in vest pocket. Send $1 in cash, money order or check and receive slide rule with genuine leather case and instructions. Box M-2.

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For amateur or professional

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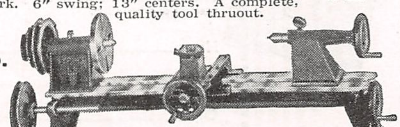


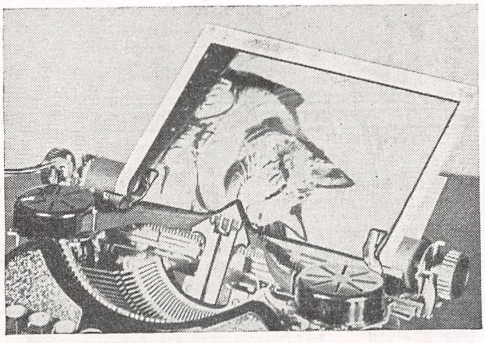
(Continued from page 140A)

The smallest tugs develop only 200 horsepower and average seventy feet in length. The largest develop about 1,200 horsepower and average 150 feet in length. The tonnage range is from sixty-five to 430. The ordinary service life of a tug is twenty-five years, but like steam locomotives, they can keep going almost indefinitely with a few repairs and alterations. There are tugboats still doing a daily job after forty years of workaday life.

Wood, the traditional material for tugboat construction, is rapidly being displaced by steel. The new tugs have steel hulls and steel superstructures, and many are powered with Diesel engines. Steam, however, has certain advantages at present. The Diesels as yet are not as flexible nor as positive in action, and swift maneuvering is a prime necessity with tugboat operation.

Photos Can Be Straightened in Typewriter

Photo prints are easily straightened by running them through a typewriter, using a sheet of paper on each side of the print to protect it against soiling or scratching.



Just turn the prints around the platen once and see how straight they come out

On most machines, it is possible to run two or three large prints through at one time. Small prints are best handled by first starting two or more sheets of paper into the machine and then feeding the prints in between the sheets. Badly curled prints should be completely rolled up on the platen and allowed to remain in the machine for a short time.

—E. L. Brokaw, New York City.

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MOTO-TOOL

DE
MOTO TOOL

10 DAY MONEY BACK TRIAL

for Home-Shop-School-Profession

Grinds, drills, engraves, routes, carves, sharpens, polishes and does hundreds of jobs quicker, better and with greater precision. Handles easily as a pencil—weight only six ounces, and is **amazingly powerful.** 110-Volt Universal Motor—about 20,000 r.p.m.—oilless self-aligning ball thrust bearing. Handy built-in switch. Easily replaceable brushes. Universal Collet Chuck. Bakelite housing. **You must see and use it to appreciate its tremendous value.**

Order on 10-day trial. Money refunded if not more than satisfied. Booklet Free. 20-piece Craftsmans Tool Set for all types of Moto-Tool work, $5.75.

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2812-Ct., Racine, Wis.

New "OUTBOARD" Motor Sled READY

For Home Builders!

Now you can *easily* build Mead's new, streamlined MOTOR SLED *at home* from drawings, parts or complete Construction Kit! Uses OUTBOARD or other engine. Low cost. Amazing speed. Seats 2. *Also* Ice-Boats, Ki-Yaks, Sailboats. *Rush* 10c for illustrated literature. **MEAD GLIDERS,** 15 S. Market, Dept. 12-B, CHICAGO.

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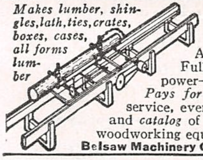
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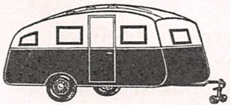

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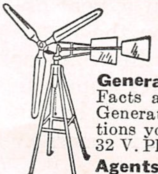

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7" (½" hole)	$4.40	10" (⅝", ¾" hole)	$6.20

KEYSTONE
HOME WORKSHOP

ALSO,— your dealer has amazing values, at $1.20 to $2.00, in Keystone Disston-made Circular Saws! Ask to see these Keystone Saws, made by the world's foremost sawmakers. They will give you good service in your home workshop.

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Keystone Hollow Ground Combination

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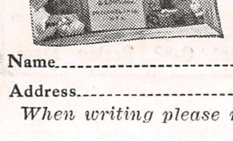
In Canada, prices slightly higher



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use Disston Saws, Tools, Files, in your home workshop. How to choose, use, care for, these fine tools, is shown in this Disston Manual, sent **FREE**

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COMPARE THESE PRICES TUBE FOR TUBE, FEATURE FOR FEATURE, WITH ANY RADIO ON THE MARKET

✲ **AUTO-EXPRESSIONATOR**
Brings back the expression necessarily taken out in the studio in transmitting the program.
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✲★☽†⊙ **15 TUBES,** 44" Console, **$167.50**
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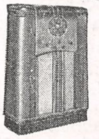
Prices slightly higher in Rocky Mountain States and west.



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Send **Now** for our BIG FREE Catalogue of Movie Supplies and films including POPEYE, BETTY BOOP, TOM MIX, etc.

PARAMOUNT MFG. CO., Dept. G-82, Boston, Mass.

The Birth of a Station

(Continued from page 858)

of the transmitter must be approved by the government, so all plans are made accordingly.

The antenna systems in common use today are known as vertical radiators. They are merely a steel tower resting on large porcelain insulators. Most of them are self-supporting, that is, they stand without guy wires. The popular sizes are half-wave and quarter-wave, meaning the tower is one-half or one-fourth as high as the electrical wave emitted. Ordinarily, they run between 200 and 500 feet. Certain stations use complicated systems of multiple towers, radio frequency transmission lines or semi-directional radiators. This elaboration is usually due to government regulation or a desire to cast a stronger signal in a certain direction. While this appears complicated, it is only a duplication of a simple vertical radiator, with the needed tuning devices.

The proper antenna system to employ is determined by the consulting engineer. The specifications are given to a steel fabricating concern, which builds and erects the tower or towers. Most of the station equipment is purchased in factory-made units, which can be connected together with wrench and soldering iron. The actual construction of the station is done by a contractor who builds everything, turning the completed equipment over to the consulting engineer for the final tuning and adjusting.

Measuring the antenna is the most interesting feature. The pickup power of a 500-foot vertical mast is tremendous. Low-power stations on the other side of the country come in like locals. It would be no task at all to log every station on the air. Instead of using a wave meter, a superheterodyne receiver is hooked to the aerial and tuned to a certain station whose wave length is known. So closely do modern broadcasters adhere to their wave length that they may be used as standard measuring units. By means of a resistance and capacity bridge and a beat oscillator a curve is plotted for the entire broadcast band. This enables the engineer to know how closely the tower comes to his specifications. Should it be off, he can correct it with top loading, condensers or loading coils. Top loading consists of placing a fringe of rods on the apex of the mast, like spokes of a wheel.

With the characteristics of the antenna known, it is a simple matter to tune the transmitter to resonance, and the station is ready to go on the air. The work of the consulting engineer is not yet done, however, for a broadcasting station is a business institution like a store or newspaper. Its customers are the advertisers who desire to reach the public. The two commodities it vends are time and coverage. Coverage consists of the ability of the station to reach potential purchasers.

This can be determined by asking people to write in for a prize or gift, but a more accurate method is to make another field survey. This time it is not five or ten miles, but 500 or more. The field intensity car zigzags about the country, often traveling thousands of miles, until all the territory in question has been surveyed. Only then is it known just how many millivolts are reaching any particular point from which an important account might receive a response. To determine coverage over a period of hours or days, a recording meter is connected to the field intensity set. It runs by clockwork and is entirely automatic. Signal strength for any period of time is traced upon a moving paper tape.

With these measurements completed and a large graph of station coverage on the wall of the sales manager's office, the important work of the consulting engineer is over. All that remains is a periodic check of the signal and equipment, until such time as another major alteration is planned.

Repairing Porcelain Articles

For filling holes in porcelain, or for uniting broken porcelain articles, I find that whiting mixed to a paste with water glass is highly effective. The mixture sets by chemical reaction, and can be tinted any shade desired with dry colors.

—R. Wailes, Bethesda, Md.

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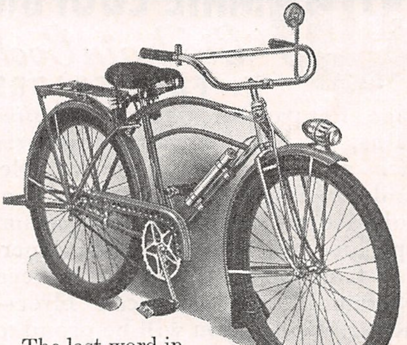
The Biggest Christmas Thrill
A NEW UP-TO-THE-MINUTE
IVER JOHNSON
STREAMLINED
BICYCLE



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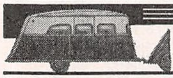

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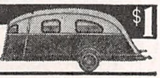

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This is your last opportunity to obtain the G. H. Q. Motor Kit. We have decided to withdraw our temporary offer of $8.50 for gas kits selling finished motors only at $12.50 after above date. The G. H. Q. Motor is actually one of the most powerful motors ever constructed! Has broken records for amazing performance—flies model planes up to 10 ft. wing spread. Easy to start, just a twist of the wrist, and simple as ABC to assemble (so easy only a screwdriver is needed). Steady running—runs 27 minutes on ounce of gas. Cylinder and piston lapped to within .0003. Kit includes plug, coil, condenser, tank, ignition wire, cylinder, piston, connecting rod, timer, crankshaft, all screws, nuts, bolts, etc. Every part is fully machined and finished. No oil, gas, batteries or propeller included. Post-paid for only $8.50
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Ready-to-Run G.H.Q. Motor complete with propeller block included; entirely assembled on stand. Tested and run before shipment—Performance guaranteed—1-5 horsepower at 3000 to 7000 R.P.M.—No oil, gas or batteries included. Postpaid for only $12.50. Send 3c for illustrated catalog including information on gas accessories.
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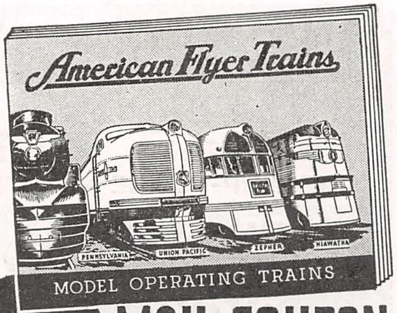
854-B East 149th St. New York, N. Y.



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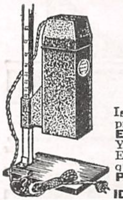

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The Caterpillars Still Fly!

(Continued from page 823)

when time is all important and the ground below full of hazards?

Recently an A-12 piloted by the late Lieut. Lawrence C. Westley with Sergt. William Kliffel in the observer's seat was flying over a forest on a practice flight when the motor developed a terrific knock. It vibrated the entire fuselage. Any second it would tear itself out of the plane or explode. The A-12 was losing altitude. Lieut. Westley gestured for Sergt. Kliffel to jump.

"Fear or nervousness was undoubtedly present for some time before the jump," the sergeant later related in his official report. "I noted a dryness in the mouth. I also recalled a burning sensation in the chest when I first definitely knew I was expected to bail out.

"It seemed like a cold-blooded proposition. I dreaded it. I had a fear of being struck by the tail group, particularly the stabilizer. On previous flights I had often noted its unfavorable position in reference to a man attempting to clear himself. A propelling thrust would be needed to effect satisfactory clearance.

"When our difficulty first made itself known, I recalled a conversation which had taken place some time before, between myself and others, in which it was decided that clearance could be effected with safety if the jumper mounted the lower stirrup, fell backward in an arc of which the foot was the center, and thrust himself away from the fuselage with the strength of his arms and shoulders. This method, however, was closed to me by the press of the emergency.

"At this time I was under the impression that the pilot, too, would jump. I had a sense of gratitude for the break he was giving me in holding the ship, but I wanted him to get out. I felt that he was taking too great a risk for somebody else. I knew that I could get out somehow without his help. But he didn't move.

"All this time—possibly two or three seconds, I was working myself over the side. I wanted to give him as good a break as he was giving me. I hurried. I knocked my goggles off. They were banging on my neck. My reasoning power at this point

(Continued to page 148A)

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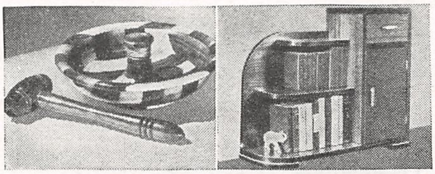

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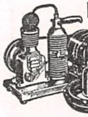

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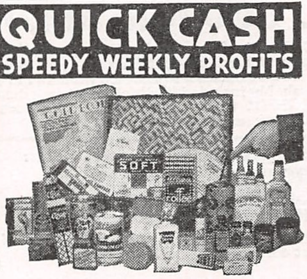

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(Continued from page 146A)

was uncanny and far superior to my normal average both in speed and accuracy. I was practically ready. The wind tore me loose.

"My first sensation was one of spinning head down. This may have been an illusion, but I couldn't focus my eyes on anything. There was nothing there except streaks. I'd seen jumpers tumbling end over end. I didn't think I was doing that. I wondered if I'd fouled my 'chute. I wondered who packed it. I was definitely not afraid at this time. I felt like a man who had taken a definite step in an unknown direction and waited for the results in some curiosity. I knew I should wait for an instant before pulling the rip cord. I reached for it and couldn't locate it.

"I wondered if I could see my hand if I held it before my eyes. I could. The ripcord handle was in it. The cable was dangling. I felt silly for some unknown reason, as though I hadn't done it properly. I was becoming interested again. I wondered if I'd make it. I could feel a positive friction under my seat. It made me feel good. I knew the 'chute was working—that it was pulling out.

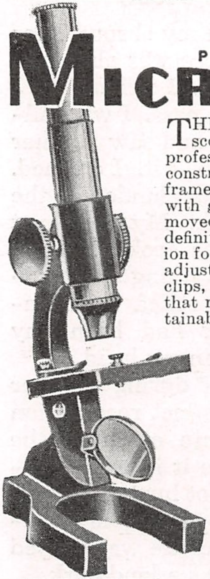
"I wished I could see what was happening. I could feel a tugging and it was gentle. This wasn't bad. I had a sensation of bouncing as though I were on a rubber band. My reasoning power was gone. Things were happening too fast. I could not think them out. They were just pictures but very, very clear.

"I saw the earth once in a while. It looked like I was still spinning. My feet were down now, though. It seemed like the whole parachute was spinning. I was able to reason this out. I decided that the canopy was steady but that the shroud lines were swinging in a circle with me. I saw some buildings in the distance. I remembered the airplane. I wanted to see it. I wondered about the pilot. I wondered if he made it.

"I saw the airplane. I could see the pilot now. His head and shoulders were above the outline of the ship. Things were getting steady now. The pilot was standing up.

"I was dropping in the woods. I was suddenly afraid. I was falling too fast. The trees were reaching for me. I could

(Continued to page 150A)



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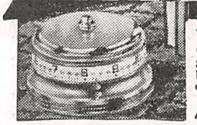

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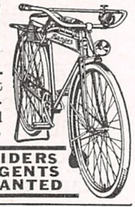

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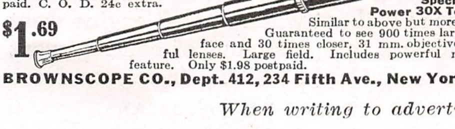

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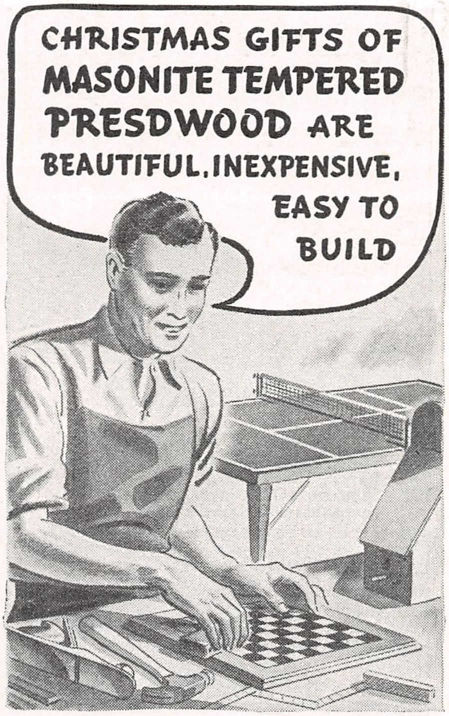
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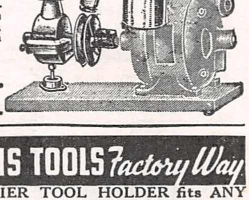

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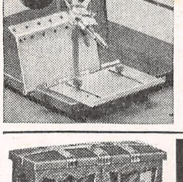

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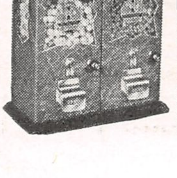

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(Continued from page 148A)

see the limbs. I grabbed my shroud lines and pulled them. One tree was almost in my way. I pulled harder. I fell faster. I missed the tree. I saw it pass. I was falling backward. I looked and saw another one coming. I couldn't miss it. I crashed. I fell through the limbs and landed on the ground, flat on my back. My foot hurt and I wondered if it was broken. I was afraid to find out. Everything was suddenly very still. It was a relief. I remembered that there never had been any noise. It was something in my head.

"At this period, either during or after my landing, I have a distinct recollection of hearing the airplane crash to the ground, but I can't place it in proper sequence. I got up. My foot hurt. I walked away. Something stopped me—my harness. I took it off. My 'chute was draped in a tree. I left it there as a landmark.

"I called Westley. I wondered if he'd made it. I could think better now. I was out of the woods and looked all around. I saw something white in the west. I thought it was an oil tank. I watched it and it seemed to move. It was a long way off. It was a parachute—Westley. He was hurt, otherwise he'd be up and the 'chute would be collapsed.

"I ran. I was in a bog. It was deep. The water was cold. My foot hurt worse. I saw a man on a horse. He stopped by the parachute. Then some more men on foot. I was all in. Now they saw me. They were putting me on the horse. I couldn't mount. They told me that Westley was dead."

And so Sergeant Kliffel became a Caterpillar.

Sometimes the action of the ill-fated plane makes it extremely difficult for a flyer to bail out. Sometimes, on the other hand, the plane in some uncanny manner seems to facilitate the process. There is no predicting just what an airplane that has met with a mishap will do as two new members of the Caterpillar Club, Sergt. Percy G. Smith and Maj. H. T. McCormick, recently discovered.

Sitting in the navigator's cockpit of a bomber, Sergt. Smith was ordered by the pilot to bail out when the left engine went dead and the plane, out of control, went into a flat spin. While trying to force

(Continued to page 152A)

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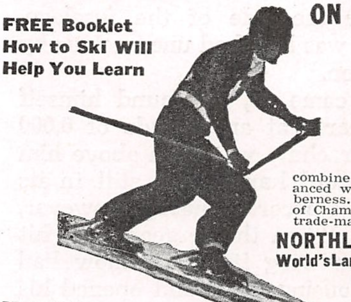

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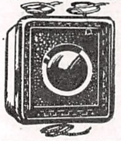

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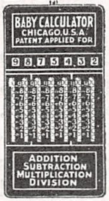

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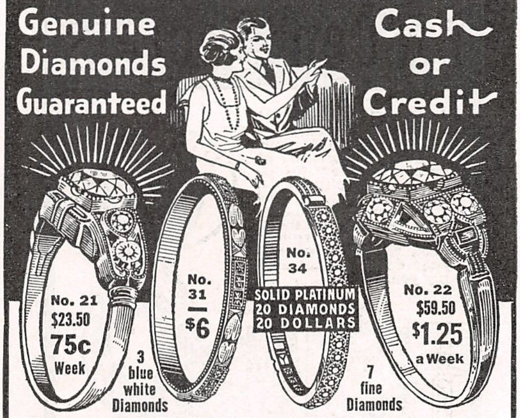

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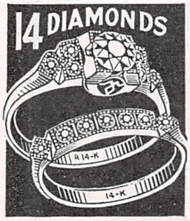

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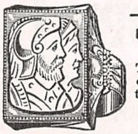

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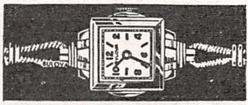

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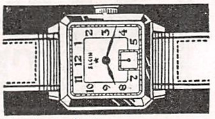

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to your shop, home, office, store, garage, etc.? Why be in doubt? Don't take chances. Learn how to reset your own cylinders so that keys that may be in the hands of old tenants and landlords or perhaps burglars will not work. Our locksmith manual for resetting cylinders sent for $1. After several minutes with our manual you will be able to reset cylinders very easily.
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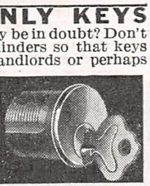
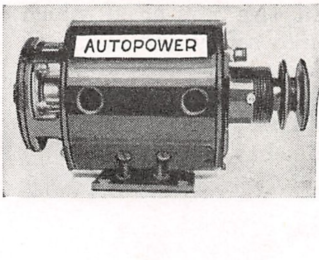


Midwest Locksmiths, 3711-E-W. Chicago Ave., Chicago, Ill.



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The new "1936" edition of "AUTOPOWER" with all the original specifications and many new ones is now off the press. The book is plainly written and illustrated—the instructions easy and simple. Change auto generators into practical A. C. and D. C. generators and motors, with voltage from 2 to 1,000 volts, for power, light, welding, radio, sound, etc. No experience nor special tools needed to make these economical changes. Generators can be driven by wind, water, fan-belt, etc. Already used and endorsed by thousands. Send for your copy today. Price only $1 postpaid.

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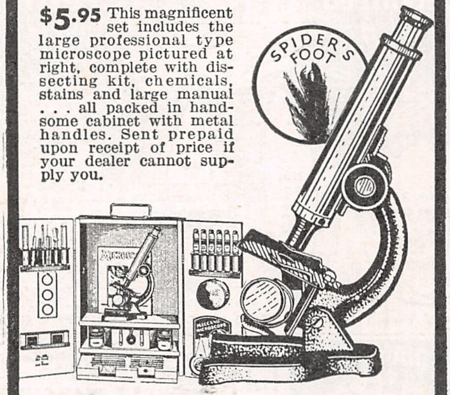
See Nature's Hidden Secrets

$5.95 This magnificent set includes the large professional type microscope pictured at right, complete with dissecting kit, chemicals, stains and large manual . . . all packed in handsome cabinet with metal handles. Sent prepaid upon receipt of price if your dealer cannot supply you.



FREE Fine illustrated catalogue showing other Microscope sets ranging in price from $1 to $10; also additional members of the Meccano family, including the new Meccano-Morecraft. *Use the coupon today.*

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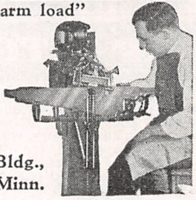

writes D. R. Williams, Marysville, Calif. "I have about 3 day's work piled up now. If it keeps up I will have to get another FOLEY SAW FILER." YOU, too, can succeed in saw filing with a FOLEY Automatic Machine. Files hand, band and circular saws perfectly, quickly. Earn up to $2 or $3 an hour. No experience needed. Cash business, no canvassing. Send postcard for FREE PLAN, no obligation.

FOLEY MFG. CO., 1216-6 Foley Bldg.,
11 Main St. N.E., Minneapolis, Minn.

(Continued from page 150A)

himself over the side of the fuselage, Sergt. Smith was knocked unconscious by the left aileron.

When he came to, he found himself floating to earth at an altitude of 6,000 feet. The parachute was open above him but the rip-cord handle was still in its pocket. The rip-cord housing, however, was broken. When the sergeant had hit the wing, the wing itself somehow had pulled the housing apart and opened his 'chute while knocking him unconscious.

The experience of Maj. McCormick touched the opposite extreme. While flying his pursuit ship over Elizabeth, Ind., at an altitude of 2,200 feet, his propeller broke and the plane vibrated so violently he was stunned by the windshield which struck him on the head.

By the time he recovered, the ship was down to 1,000 feet. He cut his switches but as the "ground" had been pulled loose by the violent vibration, the engine did not stop. It began to come apart, metal fragments flying in all directions. The plane lost altitude rapidly. The major shoved himself over the side head first, and his shoulder struck the tip of the stabilizer. Finally he was in the clear and he pulled his rip cord.

But his troubles were not over. The 'chute opened and as it did so, the risers caught him around the neck, choking off his air. With his head imprisoned between the risers he was forced to look skyward until he was approximately 300 feet from the ground. Then, after a great effort, he succeeded in freeing his head from the twisted risers.

The members of the Caterpillar Club have run the gamut of aerial experiences, from the humorous to the most tragic. They have no clubhouse or common meeting place and their complete experiences are chronicled only in official reports and in occasional bulletins of the Air Corps News Letter, issued by the Army Air Corps. In many a tense but unseen drama of the skies, they have fought free of their disabled planes, won their way over the side and pulled the rip cord which launched them into safety and membership in the exclusive club. Putting their faith in an aerial life preserver, they have become "Caterpillars." And as Caterpillars, they have lived to fly again.

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FOR BETTER RADIO
THE HAMMARLUND "37" CATALOG

Including a profusely illustrated Special Bulletin describing the famous 16-tube HAMMARLUND SUPER-PRO RECEIVER. *Address Dept. PM-12.*

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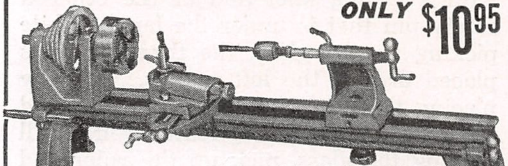
NEW SCREW FEED LATHE

ONLY $10.95



No. 355-6 x 18″ METAL TURNING LATHE WITH LONGITUDINAL SCREW FEED. Length overall 30″. Machined semi-V ways. Threaded hollow spindle No. 0 MORSE TAPER CENTERS. 4-step pulley mounted between TWO BRONZE BEARINGS. TAPERED TAKE-UP BEARING. ½″ tailstock set-over. Compound carriage travels on semi-V ways gibbed for take-up. Compound swivels thru 360°. Included: Two 60° centers, tool post assembly and 4″ face plate.—3″ four jaw chuck $3.50; 4″ chuck $4.50; Chuck adapter bushing 50 cents. Tapered arbor with flanges and nut and ¼″ chuck 89 cents. Send $2.00 with order, balance C.O.D. Shipping weight 30 lbs.

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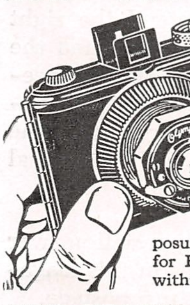

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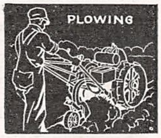

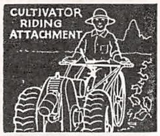

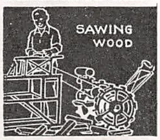

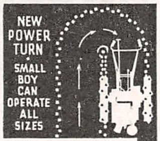
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New 1936 Model Has 3 Speeds Forward, and Reverse. Special to Order, 6 Speeds Forward—runs from ⅛ mile to 15 miles per hour. **New Power Turn** enables Shaw to turn in its tracks with no lifting or pushing. **Reverse Gear** makes it easy to work among rocks, roots, in close quarters. **Tool Attachments** for different uses. Convenient Jiffy Hitches. Patented tool control. Width adjustable. Briggs & Stratton **air-cooled**, 4-cycle engine. **4 Models, 2 to 5 H. P.,** Walking and Riding Types.

Available With Air or Steel Tires. Air tires save 25% fuel. Enable Shaw to do more work in a day. Provide better traction.

LOW FACTORY PRICE!! Mail Coupon for details of price and terms today!

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10-DAY TRAIL OFFER! Use on your own work for 10 days. Know how Shaw makes you much more money—with less work and trouble! Mail Coupon for details 10-DAY TRIAL OFFER today!

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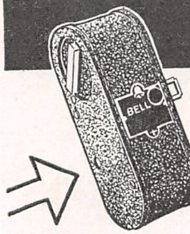
full size **Movie Camera** for only **$7.50** *complete*



● Genuine full size (not a toy) movie camera — using standard 50 ft. rolls of 16 M.M. film, any make — at an amazing low price. New invention but tested and proved efficient, easy to operate, high standard results. Special, built in, no adjustment lens makes it easy for any one to use. Beginners and experts alike are amazed at the beautiful life-like pictures. This new **BELL MOVIE CAMERA** has accurate view finder, simple key wind, highly sensitive lens, **uses any make full size, 16 M.M. film,** and is

Automatic — *No Cranking Necessary*

Anyone can now take excellent movies as easily as with an ordinary camera and be sure of fine pictures. This introductory price cannot be guaranteed for long. Sent POSTPAID on receipt of only $7.50 for camera complete, fully guaranteed and on 10 days trial. If you prefer, send only $1.00 and camera will be sent C. O. D. for balance of $6.50 plus postage.

MONEY BACK promptly if you are not perfectly satisfied. Send NOW and take advantage of this introductory price. RUSH.

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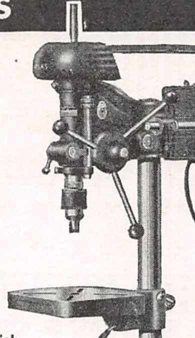
1937 *Atlas* DRILL PRESSES



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Please send your new 1937 Catalog.
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"Magic Pays Dividends"

(Continued from page 877)

top, place it in the glass. When you remove your hand, the glass remains suspended in midair.

To prove there are no hidden strings, change the ruler from the right to the left hand and pass your other hand in front, back, above, below and behind the glass. At the conclusion, allow the audience to examine both the glass and ruler.

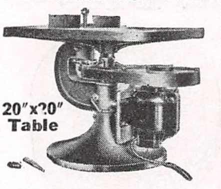
The secret lies in using a piece of black thread about seventeen inches long and doing the trick preferably against a dark suit. At one end of the thread is a loop with a sliding knot and at the other a safety pin that is under the lapel. While picking up the glass, the thread loop is placed around the left fingers. Then by placing the glass in the loop, the thread will automatically tighten itself. Still holding the glass, pick up the ruler and place it inside. The hand may be removed without danger of the glass falling because of the light pressure of the foot ruler against the glass. The ruler may be changed from one hand to the other as long as it is held against the glass. When passing the hand behind the glass be sure it stays clear of the thread. For a good punch finish, hold the top of the glass and pass the ruler completely around it, thus releasing the thread.

The floating card trick belongs in the repertoire of every amateur entertainer. The magician holds a card in front of him and at his command, it will travel from one hand to the other. This trick also needs free space between the performer and his audience. A card is threaded as shown in the diagram. The loop should be left fully extended on the right side of the card. In starting the routine, put the thumb through the loop and secure the free end on the left side with the left thumb and forefinger. Extend the right hand with the loop of thread around the thumb. Pull lightly with the thumb, freeing the card from the left hand, which automatically pulls it to other hand. The left hand should be kept in its original position.

¶Our Bureau of Information will answer questions regarding articles in this magazine, if accompanied by return postage.

AMAZING BIG BARGAINS IN WOODWORKING EQUIPMENT
WONDERFUL LASTING XMAS GIFTS

SENSATIONAL NEW SPINDLE SHAPER



At last a man-sized SHAPER within the reach of all home shops. Simple, accurate, practical and dependable. Fully adjustable. Spindle raises-lowers. V-Belt drive. High speed—8,000 R.P.M. New Departure double sealed ball bearings. The year's best buy at our low direct factory-to-you prices. Write us now.

SCROLL SAW—JOINTER—SAW TABLE
BAND SAW Write for the new FREE Blue Star catalog describing and pricing complete line of modern heavy duty woodworking equipment and accessories. Remember factory-to-you prices, no agents, no dealers. Factory guarantee. Act at once.

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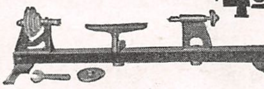
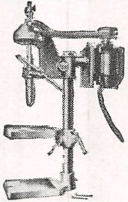
Imagine a heavy duty steel bed WOOD LATHE, 48" long at this amazing price. Three step cone pulley for V-Belt—extra long oilite bearings. Tool rest 8" long. Face plate included. Shipping wt. 30 lb. Full line of accessories available. Order direct from this advertisement F. O. B. Factory or write for new free catalog.





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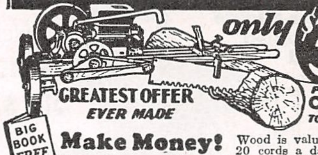

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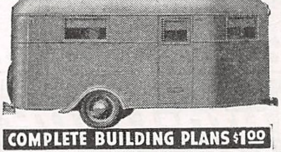

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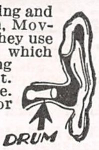
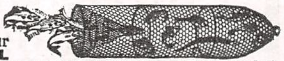


A. O. LEONARD, Inc., Suite 699, 70 5th Ave., New York

Catch Fish!



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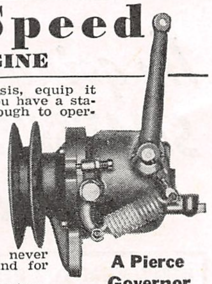
Governs Speed
OF ANY GAS ENGINE



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TYPEWRITER ½ Price

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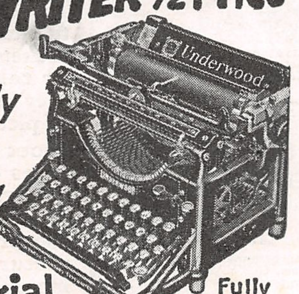

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Lowest Terms—10 Cents a Day
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Send coupon for 10 day Trial—if you decide to keep it pay only $3.00 a month until $44.90 (term price) is paid. Limited offer—act at once.

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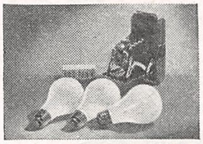
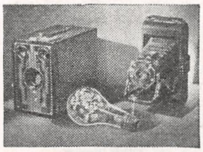
For quick shipment give references and occupation

I'm going to take SNAPSHOTS AT NIGHT *on Thanksgiving, too!*

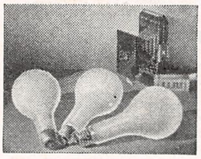
HERE'S WHAT YOU NEED TO TAKE THEM



Fast lens cameras—F/6.3 or faster—"SS" pan film and G-E MAZDA Photoflood lamps No. 1. 25 cents list.



Any camera that can be set for time, G-E MAZDA Photo**flash** lamps. Each lamp gets one picture. 15 cents list.



Inexpensive folding cameras, (F/8) "SS" pan film and G-E MAZDA Photoflood lamps No. 2. 50 cents list.

Try some snapshots indoors or at night *with your camera.* It's fun. And it's easy . . . thanks to G-E MAZDA Photoflood lamps.

These bulbs provide picture-taking light from the sockets of your bridge or table lamps. And they're good for dozens of pictures.

Shoot some indoor pictures of your Thanksgiving. Or get that birthday celebration. The sooner you begin to snap pictures at night the more fun you will have. Your druggist or camera dealer can supply you with lamps. To be sure of dependable light, look for the mark ㊎ on the end of Photoflood lamps . . . and on the disk inside Photo*flash* lamps.

Ask your dealer for a copy of "How to take snapshots at night." Gives simple, easy-to-follow directions and helpful hints. Or write General Electric Company, Department 166, Nela Park, Cleveland, Ohio.

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AT NIGHT

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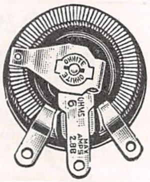

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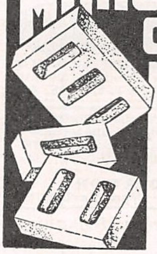

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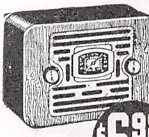

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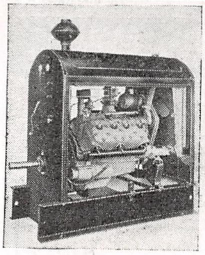

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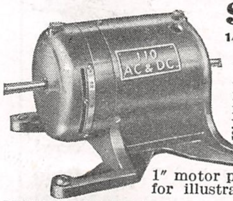

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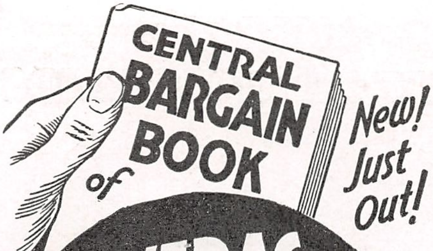

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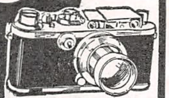

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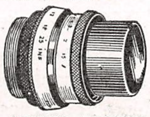

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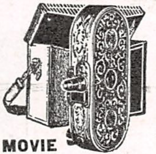

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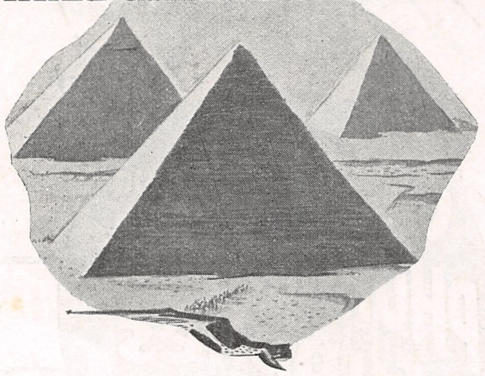

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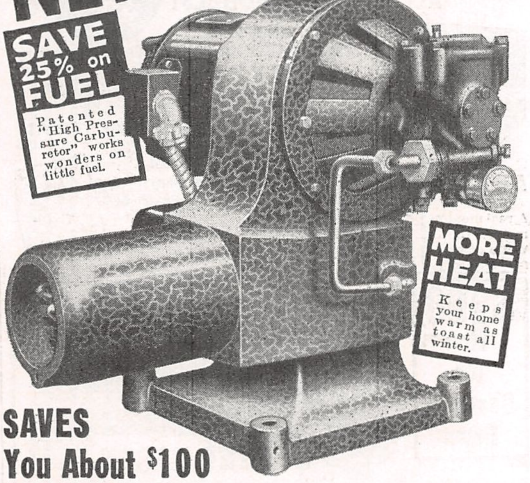

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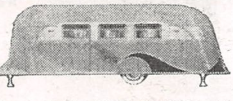

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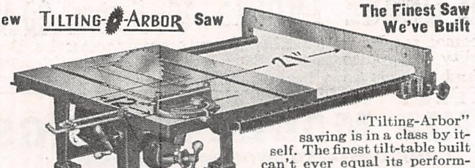

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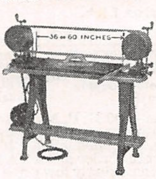

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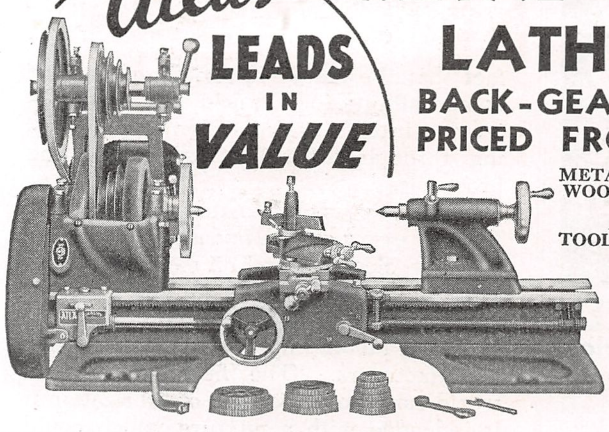

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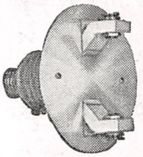

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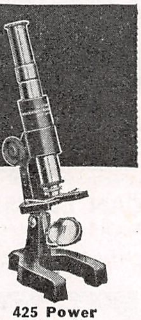

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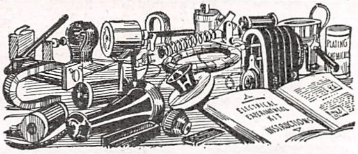

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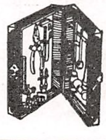

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Why Your Car Needs an Oil Filter

(Continued from page 868)

fact that the cotton in the filter element has an affinity for the acid, and other filters are intended to condition the oil passing through them by various treating processes.

"Every automobile needs an oil filter because every engine is designed to operate with clean oil and oil cannot be kept clean under operating conditions unless it is filtered," says L. W. Williams, chief engineer of Motor Improvements, Inc., filter manufacturers. "The finest oil in the world can't do a good job of lubrication if it is loaded with a mixture which could be used to grind valves.

"The time to prevent sludge is before sludge forms. You can't drain it out of the crankcase with your dirty oil and you can't flush out the sludge that has become fixed around bearings and in oil passages. The only way to get rid of that is to drop the case and scrape and clean it away.

"Filters used to be designed merely to remove abrasives. This was highly important, but a good filter today removes not only solids but soft carbon and everything that discolors your oil.

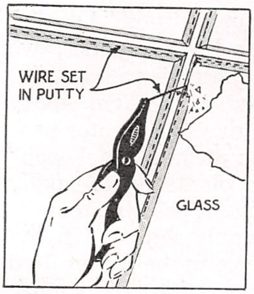
"Every motor has its own individual characteristics, so there's no hard and fast rule for renewing your filter or filter element. Since a good filter removes everything that discolors oil, however, it's a good idea to watch your oil and inspect your filter element as soon as the oil seems dirty to the eye. Drop a little clean oil on a white blotter and beside it a few drops of oil from the paddle of your crankcase. If the oil from the case appears appreciably darker than the clean oil it should be changed and your filter probably needs a new element."

If your automobile came equipped with a reliable filter and you have changed filter elements regularly, it is unlikely you ever will need to clean out your crankcase with flushing oil. If, however, you are installing a filter on a car which has been driven without one, it is not only desirable to flush the case, but to drop it and scrape and wash away the accumulated sludge before installing the filter. And if you do flush a case equipped with a filter, be sure to disconnect the filter first or you may dislodge the dirt the filter has accumulated and send it back into the oil stream. This is important because a dirty filter often holds four or five ounces of solids.

Some filters seal themselves off when loaded, but others "unload" back into the oil stream. In either case, a dirty element is better off the car than on it. Some improperly designed filters are inefficient after a few hours of use and others actually do more harm than good if the filtering element happens to be an abrasive and the design is such that the abrasive can be unloaded into the oil stream with continued use.

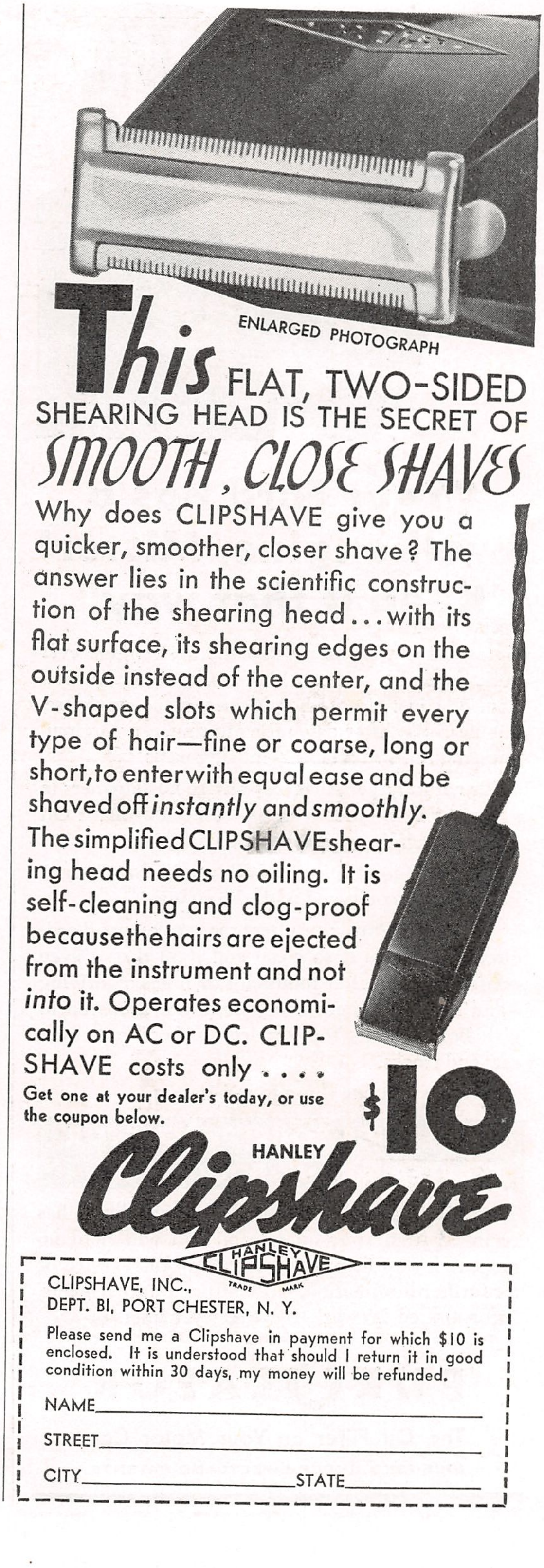
So it is well to exercise even more care in selecting a filter for your car than you would in buying a product whose operations are visible, for, of course, you cannot see an oil filter work. The best rule is to select a recognized product turned out by a reputable manufacturer and sold by a dealer in whom you have confidence. Don't take a chance on a "reconditioned" or "rebuilt" filter. You can avoid them by buying in the original carton of a reputable manufacturer.

Wire Imbedded in Window Putty Simplifies Pane Replacement



One nurseryman simplifies the job of replacing broken panes of glass in his greenhouse by imbedding a length of fine wire in the soft putty when the glass is put in. When a broken pane is to be replaced, he simply digs into the putty at one corner of the sash, grips the end of the wire with a pair of pliers and pulls it. This removes most of the old putty so that it takes only a few minutes to prepare the sash for the new glass. The wire is, of course, completely hidden by the putty.

¶Cat and dog hairs may be removed from clothing or upholstered furniture by brushing it with a clean, dry sponge.


ENLARGED PHOTOGRAPH

This FLAT, TWO-SIDED SHEARING HEAD IS THE SECRET OF

SMOOTH, CLOSE SHAVES

Why does CLIPSHAVE give you a quicker, smoother, closer shave? The answer lies in the scientific construction of the shearing head . . . with its flat surface, its shearing edges on the outside instead of the center, and the V-shaped slots which permit every type of hair—fine or coarse, long or short, to enter with equal ease and be shaved off *instantly* and *smoothly*. The simplified CLIPSHAVE shearing head needs no oiling. It is self-cleaning and clog-proof because the hairs are ejected from the instrument and not *into* it. Operates economically on AC or DC. CLIPSHAVE costs only **$10**

Get one at your dealer's today, or use the coupon below.

HANLEY **Clipshave**

HANLEY CLIPSHAVE TRADE MARK

CLIPSHAVE, INC.,
DEPT. BI, PORT CHESTER, N. Y.

Please send me a Clipshave in payment for which $10 is enclosed. It is understood that should I return it in good condition within 30 days, my money will be refunded.

NAME______________________________

STREET______________________________

CITY________________STATE__________

"Your Ford has a swell engine, Mister! Keep it that way"

Garage men well know that the best engine ever built depends on clean, high-grade oil for protection. Not just clean when it goes in the crankcase, but clean day after day, mile after mile, as it circulates and lubricates closely moving parts.

It's natural, then, that they advise Ford owners to protect their engines with a GENUINE Purolator Oil Filter especially engineered for Ford V-8s.

The cost ($3.25, plus a small installation charge) is as nothing compared with the saving.

A Genuine Purolator filters the crankcase oil as it circulates, keeps it so clean and pure that it even retains its color after thousands of miles of driving —and service garages everywhere are prepared to give Ford owners this service, on both passenger cars and trucks.

There is just one thing to remember:

RE-SERVICE YOUR PUROLATOR AFTER ABOUT 8000 MILES

That is because it is full of sludge and dirt it has removed from your oil stream, and will hold no more. Ask your favorite station about this service, or for further information, write Motor Improvements, Incorporated, Newark, New Jersey, makers of

PUROLATOR

The Oil Filter on Your Motor Car

LICENSED UNDER SWEETLAND PATENTS

U. S. to Europe by Air

(Continued from page 803)

Present plans of Deutsche Lufthansa call for the "Schwabenland" and another, but larger, catapult ship to be stationed in the North Atlantic, one at the Azores and the other off Bermuda. These ships will be able to handle the twin-motored Dornier Wal flying boats with which the service will be started, possibly in the spring of 1937.

The catapult ship is powered with Diesel engines. Its equipment for launching the ten-ton planes weighs more than 100 tons and is designed to handle aircraft up to sixteen and one-half tons gross weight. Air compressed to a pressure of 2,300 pounds per square inch is used to give an acceleration of about 112 feet per second to the plane, resulting in a speed of ninety miles per hour at the point where the plane leaves the runway. This remarkable speed is built up in a run of slightly more than 100 feet.

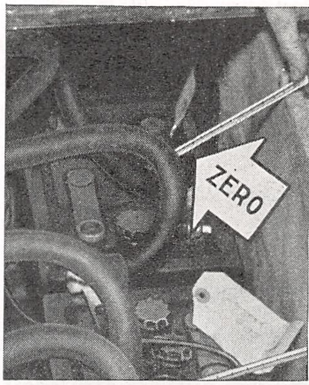
An electric crane hoists the flying boats from the water. In rough weather the crane can be folded on deck. A powerful searchlight, necessary for spotting the planes on the water in night landings, also is part of the equipment. A "towing sail," attached to the stern and floating on the water, creates a smooth "wake" behind the ship when it is in motion. Flying boats can land on this wake with less danger than in the open sea.

The flying boats, "Zephyr" and "Aeolus," also are equipped with Diesel engines, two to each plane. Each engine is rated at 500 horsepower. Mounted in tandem above the wing, one engine drives a tractor propeller and the other a pusher. Fuel economy of these power plants is unusually high, in contrast to that of gasoline motors.

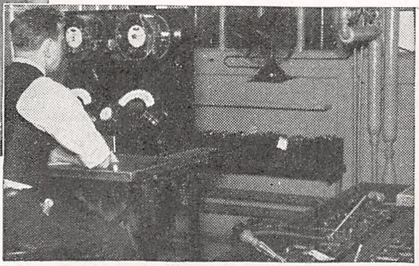
Choice of the catapult ship and flying boat for the new service probably resulted from Lufthansa's operation of similar equipment in the South Atlantic. From Berlin to Santiago, Chile, a distance of 9,500 miles, planes have been making biweekly trips with mail for several months. The 1,900-mile jump across the Atlantic to the nearest point in South America is accomplished by catapulting the flying boats from ships stationed near each end of the water hop. Thus, the flying boats have

(Continued to page 170A)

RIGID TESTS PROVE QUALITY OF *Genuine* Ford Batteries



Genuine Ford Batteries undergoing the cold test in refrigerator where zero temperature is maintained, at the Ford Battery Testing Laboratory at Dearborn, Michigan.



These sensitive meters accurately measure battery capacities. The batteries in the tank to the right are undergoing a normal discharge test.

The high-rate discharge test—equivalent to holding down the starter button for eight minutes.

IMAGINE holding down the starter button on your car for eight minutes! Imagine discharging and recharging your battery 45 times with an overcharge of 100 per cent each time! Imagine overcharging your battery at a 10-ampere rate continuously day and night for thirty days!

Hard on your battery? Yes! Yet these are only a few of the severe laboratory tests that Genuine Ford Batteries, used in Ford cars and trucks, must pass. No wonder millions of Genuine Ford Batteries in service throughout the world have proved their ability to give long, trouble-free service—even on the toughest jobs.

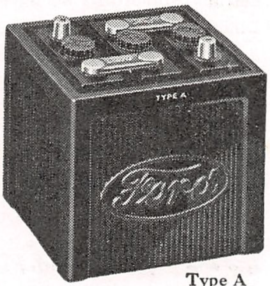
Plates used in Genuine Ford Batteries are of the highest quality materials. They have exceptionally large areas. Only vertical-grain wood separators are used. Posts are fused to lead inserts in the cover to provide additional strength. And cell covers rest on ledges in the case to provide better support for the elements inside.

Regardless of the car or truck you drive, when your battery must be replaced, remember that with a Genuine Ford Battery you can be certain of Ford quality, Ford standards of workmanship and Ford rigid inspections and tests. You can be certain of genuine satisfaction.

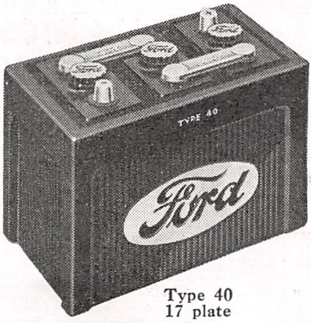
FORD MOTOR COMPANY • DEARBORN, MICHIGAN

GENUINE Ford PARTS & ACCESSORIES

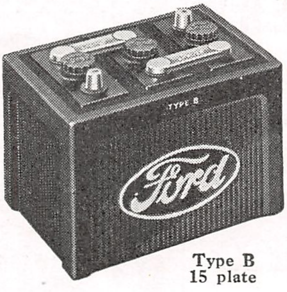
The complete line of Genuine Ford Batteries consists of a 13-plate battery, two 15-plate batteries and one 17-plate battery. The last is used as standard equipment in Ford cars and trucks.



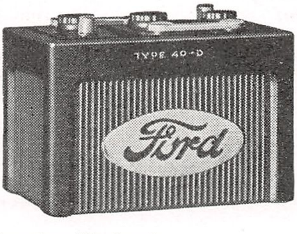
Type A
13 plate



Type 40
17 plate



Type B
15 plate



Type 40-D
15 plate

ONE FILLING OF OIL *gives as much as* 42 HOURS' COMFORT

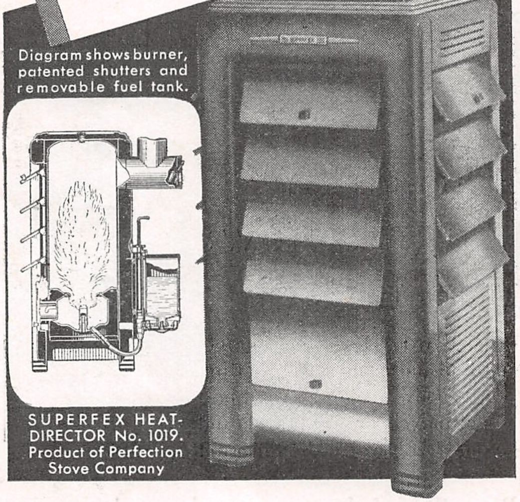


Diagram shows burner, patented shutters and removable fuel tank.

SUPERFEX HEAT-DIRECTOR No. 1019. Product of Perfection Stove Company

SUPERFEX HEAT-DIRECTOR—the only heater giving circulating, radiating and DIRECTED heat, all from the same stove! Dial control makes it possible to keep the fire for as many as forty-two hours on one filling of the removable five-gallon oil tank.

Patented shutters on three sides of the porcelain enameled cabinet may be opened at any desired angle to DIRECT heat rays downward to warm the floor. Your dealer will demonstrate. Send for booklet showing eight new Superfex models, including Radiating Heaters, also in modern design.

The mark of Quality

SUPERFEX △ *Oil Burning* HEATERS

PERFECTION STOVE COMPANY
7758-C Platt Ave., Cleveland, Ohio

Please send me complete information about Superfex Heat-Directors and Radiating Heaters.

Name ____________________

ST. or R. F. D. ____________________

Post Office ____________________

County ____________________ State ________

Home Craftsmen, Schools, Hobbyists

METAL CASTINGS

produced in your own workshop allow you to design and build your own GASOLINE ENGINES, STEAM ENGINES, STATUARY, ART OBJECTS, SPECIAL TOOLS, NEW INVENTIONS, ETC. You can also make forgings and case harden steel. Your shop is not complete without a FOUNDRYETTE. Three sizes are available capable of making bronze castings of 1½, 3, and 6 pounds weight, aluminum, copper, brass, etc., in proportion to specific gravity.

Domestic gas supply and 110 volt 60 cycle energy required for operation.

Size	Crucible Capacity	Shipping Wt.	Wt. Casting	Price Complete
351	6 cu. in.	25 lbs.	1½ lbs.	$ 9.50
352	12 cu. in.	40 lbs.	3 lbs.	15.00
353	24 cu. in.	65 lbs.	6 lbs.	23.50

For 110 volt D. C. or 25 cycle Universal motor instead of 60 cycle motor add $4.00. Aluminum Casting Alloy 30c. Prices f. o. b. K. C. Check or money order acceptable, express charges C. O. D. Write for circular.

KANSAS CITY SPECIALTIES CO.
P. O. Box 6022 Kansas City, Mo.

WIND SPRINGS *Yourself!*

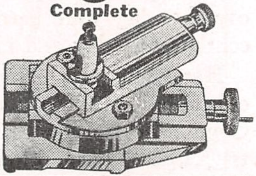
$1.95 Per Outfit Postpaid

Machine Shops, Inventors, Small Lot Mfrs.—SAVE COST ON ONE PROJECT. ROTO-TENSIONED MUSIC WIRE and TOOLS. A new, rapid process (pat. pdg.) makes springs any diameter, length, open, closed—0.010 to 0.078 inch. Outfit includes 3 permanent tools and assorted sizes highest grade music wire, enough for 20 4" springs. Additional wire reasonable even in small quantities. Wire in Roto-Tensioned for it is non-snarling, non-waste.

Send $1.95 (M. O. or Check) for the outfit—POSTPAID.
ROTO-TENSION CO., 70 Fulton St., New York City

COMPOUND SLIDE REST

Only $3.75 Complete



Here is equipment that will enable you to do metal turning right on your own lathe. A compound slide rest that can be made to fit most any lathe. Has transverse and longitude feed. Compound slide base revolves on cross slide. All ways carefully machined and gibbed for adjustment. Fine tool post, rocker washer, and cutting bit included. Worth much more. Take advantage of this sensational "buy." Rush $1.00, balance C.O.D.

PHILADELPHIA MACHINERY CO.
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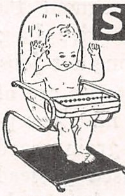
Sell Without Canvassing!



AGENTS WANTED

When you sell the Teeterbabe Jumper & Auto Seat, you don't have to waste time calling at every house. Just get a birth list—or each mother you call on will tell you right where to find another baby. You know where to call. Babies being born constantly all around you. Mail circulars to mothers. They'll keep you busy. We tell you how. Teeterbabe has no equal in the home and auto. Best quality. Sells at bargain price and big profit. Write today for Sample offer. Exclusive territory to those who qualify.

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SKINNY FOLKS GAIN 10 TO 25 LBS. QUICK

-with new 3-way treatment

SCIENCE DISCLOSES 3 REASONS WHY THOUSANDS ARE SKINNY

Thousands Gain Solid Flesh—*in a few weeks!*

SKINNY, rundown people by the thousand with this new easy treatment have gained pounds of solid flesh—in just a few weeks. Not only that, but they've also gained naturally clear skin, freedom from indigestion and constipation, new pep.

Doctors now say many are thin and rundown simply because they do not get enough Vitamin B and iron in their food. Now the richest source of Vitamin B is cultured ale yeast. This special imported ale yeast is concentrated 7 times, made 7 times more powerful. Then it is combined with 3 kinds of iron, pasteurized whole yeast and other ingredients in pleasant little tablets.

If you, too, need these elements, get these new Ironized Yeast tablets from your druggist today. Then watch flat chest develop, skinny limbs fill out naturally, constipation and indigestion from same cause vanish, skin clear normally—in quick time!

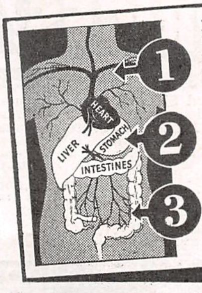
Posed by professional models

Money-back guarantee

No matter how skinny and rundown you may be from lack of enough Vitamin B and iron, these marvelous new Ironized Yeast tablets should build you up in just a few weeks as they have thousands. If you are not delighted with the results of the very first package, your money back instantly.

Special FREE offer!

To start thousands building up their health right away, we make this FREE offer. Purchase a package of Ironized Yeast tablets at once, cut out seal on box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body." Remember, results with very first package—or money refunded. At all druggists. Ironized Yeast Co., Inc., Dept. 5312, Atlanta, Ga.



1 Rich red blood, necessary to properly nourish and build up every part of the body, is especially promoted by this new discovery where iron is needed.

2 A healthy digestion which gets ALL the good out of your food, requires an adequate supply of Vitamin B. This new discovery supplies this element.

3 Normal, regular elimination to remove poisons and thereby promote health and growth, calls for adequate Vitamin B. This is the third important purpose.

When writing please mention Popular Mechanics

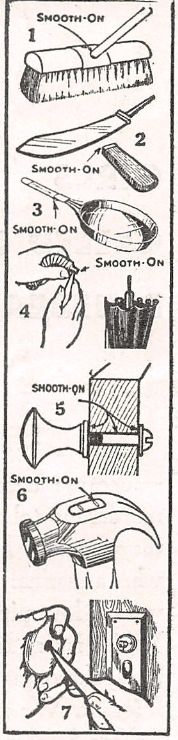
LOOSE HANDLES QUICKLY MADE TIGHT

MIX a little Smooth-On No. 1 into a putty, put this into the opening, force the parts together, and in a few minutes the metallizing of the Smooth-On produces *lasting* tightness. Such repairs cost only several cents each and save many dollars otherwise spent for renewals that are no better.

In addition to quick, effective replacement of loose handles and knobs as suggested in the sketches, Smooth-On No. 1 enables you to stop leaks at cracks and joints in steam pipes, radiators and boilers, in water pipes and tanks, in gas pipes, in automobile radiators, engine water jackets, hose connections and in gasoline and oil lines, to make loose bolts, nuts, screws, etc., permanently tight.

Smooth-On No. 1 after set and metallized holds water, steam, gasoline, oil, etc., under any pressure, and may be applied with equal success to any metal. It is also used for anchoring and taking up looseness, and holds in masonry, tiled walls, slate, wood, etc.

By doing your own household and automobile repairing with Smooth-On No. 1, all the Smooth-On repairs you make in a year will probably cost you less than any one of them made by a professional mechanic—and you will be surprised at the ease of application and the number of places where Smooth-On can save money.



HOME and AUTO REPAIRS
STOPS LEAKS
SMOOTH-ON
No. 1
CEMENTS IRON
WITH
SMOOTH-ON

Write for FREE BOOK

Keep a can of Smooth-On No. 1 in your tool box and be ready for emergencies. Do your own repairing and at the end of the year you will find that your efforts have been handsomely rewarded.

The free Smooth-On Repair Book gives full instructions.

Get Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. tins at nearest hardware store or if necessary direct from us.

STOPS LEAKS
SMOOTH-ON
No. 1
CEMENTS IRON

Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 37
574 Communipaw Ave., Jersey City, N. J.

Please send the free Smooth-On Repair Book.

Name..

Address...

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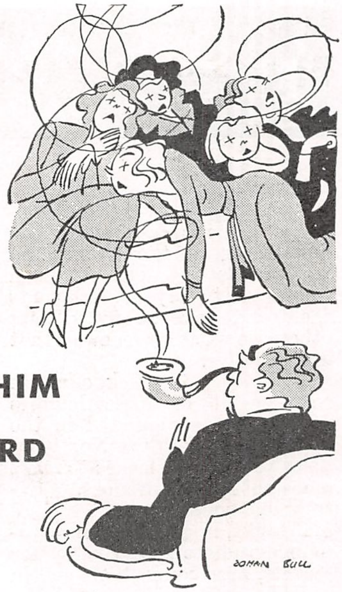


GIRLS CALLED HIM BLUEBEARD

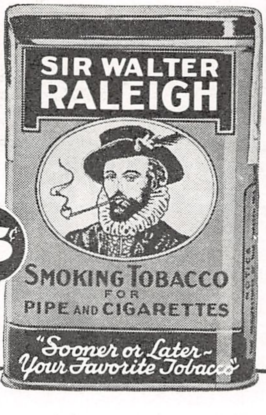
—because every time he let out a blast of murderous tobacco from his never-cleaned pipe they couldn't help thinking of the famous gent who assassinated six wives. A pity, too—when women love pipe-smoking done in the right way. Which is? 1. Keep your pipe tidy. 2. Switch to the tobacco that burns cleaner and smells more fragrant. We modestly admit *that's* Sir Walter Raleigh Smoking Tobacco—an uncommonly mild blend of Kentucky Burleys delightful to both smoker and audience. How such superlative tobacco can be only 15¢ is *our* worry. Try a tin. You'll bless us.

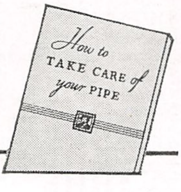
SWITCH TO THE BRAND OF GRAND AROMA

FREE booklet tells how to make your old pipe taste better, sweeter; how to break in a new pipe. Write for copy today. Brown & Williamson Tobacco Corporation, Louisville, Kentucky. Dept. P-612

15¢

UNION MADE





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NEW HOME BUSINESS!

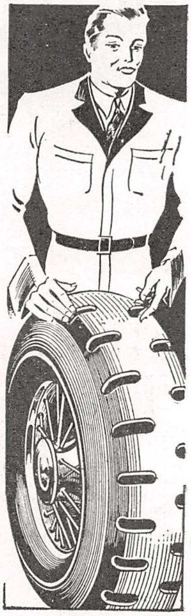
A Sensational Opportunity

for an immediate "Clean-up" making NEW

"Cover Chains"

from

Old Tires!



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Garage men; tire men; any alert man —Get into this quick, high-profit manufacturing business without delay. A simple, compact 50 lb. machine does the work quickly and efficiently. No experience needed. **Make $3 Product from 10c Old Tires!** Hundreds of thousands will want these Safety Treads; a better "chain" than steel; safe, sure traction on any road, in rain, mud, snow or ice. Complete non-skid protection. Tried and Tested by hundreds last winter here in Minnesota. Read their enthusiastic letters. Equipment cost can be earned in week! Extraordinary profit! One sells many! Start now! The season is Here!

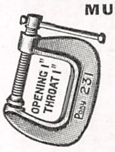
Airmail, wire or write.

PLY-MAT *Equipment* Co.

10 West 26th Street Minneapolis, Minn.

CLAMPS

MUST BE GOOD CLAMPS



You can re-sharpen a dull edge, can drive nails with an off-balance hammer but your clamps must hold or they spoil work. That is why industry has standardized on genuine "Jorgensen" Clamps to save time, work and hands. If your dealer can't supply, order direct.

ADJUSTABLE CLAMP CO.
"THE CLAMP FOLKS"
421 N. Ashland Ave., Chicago

Forgensen Handscrews

Genuine Forgensen Handscrews grip at all angles, never slip, split or loosen. All sizes. Send $2.80 plus postage (7bs.) for 2 No. 1 Handscrews open 6".

PONY MINIATURES STANDARD

Fine quality clamps with a thousand uses. 7 sizes 1" to 2½" cap. 12c each and up.

Pony 500 Fittings on ordinary ¾" pipe. Make Clamps of any length. Send $2.00 *new low price* plus postage (6 lbs.) for Fittings for .2 Clamps.

Catalog FREE

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Pony

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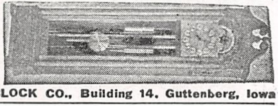
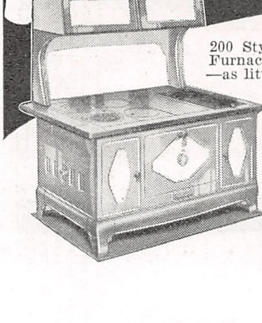
Hall clocks are high priced in stores — you can make **good money** building them or electrifying spring clocks. Dime brings "HOW" Book pricing *Brass* weight movements from $16.95 and drawing of easily built Grandfather Case—*start now*. **KUEMPEL CHIME CLOCK CO., Building 14, Guttenberg, Iowa**



Stoves AT FACTORY PRICES!



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Write for FREE Catalog.
THE KALAMAZOO STOVE CO. MFRS.
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"A Kalamazoo Direct to You"
Trade Mark Registered

Dandruff!

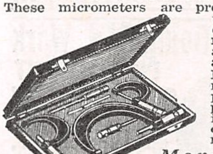
THIS MENACE MUST GO!

Lucky Tiger Hair Tonic rids your scalp of every speck of dandruff . . . used by millions . . . safe for children and adults . . . use Lucky Tiger now and enjoy the tingle of new life and cleanliness . . . costs little at druggists and barbers.

LUCKY TIGER

a real MICROMETER BARGAIN!

Genuine, American made, six piece micrometer set, in velvet lined leather case. Special price, only $11.95, a fourth off regular price and a fraction of the cost of other sets on the market.



These micrometers are precision machined for accuracy in one thousandths of an inch, up to 4 inches outside and 3¾ inches inside measurements. Guaranteed accurate, easy to read and adjust. Built to stand hard wear and give satisfaction.

Every mechanic, apprentice, garage and repair shop needs these accurate and dependable micrometers. This is your opportunity to get one at a Bargain Price if you act now. Shipped prepaid on receipt of remittance. On C.O.D. shipments, send deposit of $2.00.

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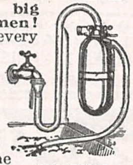

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Quick easy sale—and 100% profit—simple home demonstration sells it instantly! Write today for free literature and full details of the Webb NO RISK TEST OFFER and FREE Sales Plan.

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Trailer Division

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Full Price $3.50 $1.00 with order. Bal. C.O.D.

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and other popular projects. Easy and fascinating with our blueprints. B-10, 30-in. hexagon windmill, *Blueprint* 75c; A-2, 6-room doll mansion; blueprint 50c; knockdown kit $3.75. Illustrated catalog over 25 projects sent for 10c. Order today.

CRAFTSMAN'S MODEL CO., Dept. P37, 2030 N. 41st St., MILWAUKEE, WIS.

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Use for Grinding, Polishing, Drilling, Sewing Machine; a general purpose sturdy Motor. Operates on 110 volt, AC or DC, 5000 RPM. Height—3¼ in., Length—3¾ in., Width—3¼ in. Shaft ¼ in., one inch long. Furnished complete with detachable Arbor and ¼" Chuck, or Motor only. Price Motor Only $2.95. Arbor and ¼" Chuck $1.00 Plus 25c Postage delivered anywhere in the U.S.A. Net Weight 2 lbs. Shipping Weight 3 lbs.

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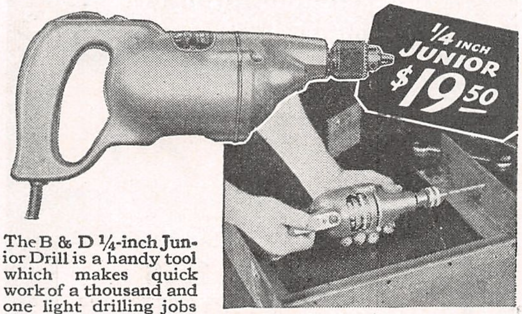
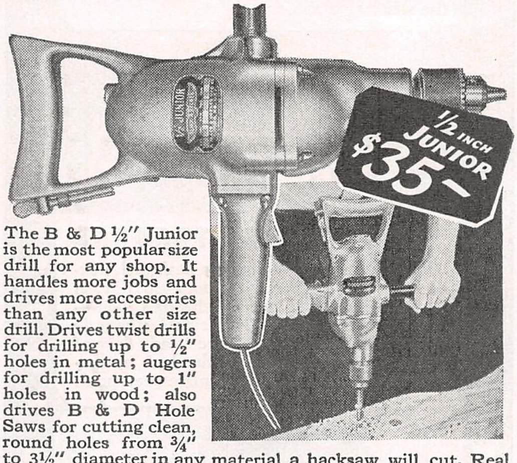


The B & D ¼-inch Junior Drill is a handy tool which makes quick work of a thousand and one light drilling jobs around every shop. Drives twist drills for drilling up to ¼" holes in metal; augers for drilling up to ½" holes in wood. Also drives light wheels for grinding, buffing, polishing, etc. Universal Motor operates on A. C. or D. C. Only **$19.50.**



The B & D ½" Junior is the most popular size drill for any shop. It handles more jobs and drives more accessories than any other size drill. Drives twist drills for drilling up to ½" holes in metal; augers for drilling up to 1" holes in wood; also drives B & D Hole Saws for cutting clean, round holes from ¾" to 3½" diameter in any material a hacksaw will cut. Real Black & Decker quality throughout. Universal motor. **$35.00.**

MAIL THE COUPON TODAY for Black & Decker Catalog and name of nearest dealer where you can see the B & D Junior Drills and other B & D Tools.

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THE BLACK & DECKER MFG. CO.,
612 Pennsylvania Avenue, Towson, Maryland

Please send Free Catalog showing Junior Drills and other tools, and address of nearest B & D Dealer.

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Occupation..........

Address..........

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GOOD UNTIL 1956

—or longer! No matter how long you own your car, if the Goodrich Kathanode Electro-Pak you buy, fails to give satisfactory service in that car, The B. F. Goodrich Company will replace it, *without charge*, as stated in the written guarantee.

BLOWS SMOKE THROUGH GLASS MAT—Specially designed, flexible, spun glass retainer mats—so porous you can blow smoke right through them—are the secret of the Goodrich Kathanode Electro-Pak's long life. Free steady flow of current assured. Loss of the real power-producing materials in the plate prevented.

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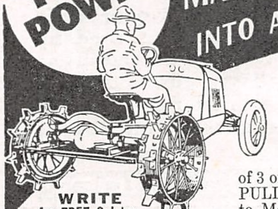
KATHANODE
***Electro-Pak* BATTERY**

CHEAP FARM POWER

PULLFORD

MAKES ANY FORD CAR INTO A TRACTOR



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Plows 5 acres a day. Discs, cultivates, harvests. Does the work of 3 or 4 horses, faster and better. The PULLFORD unit is quickly attached to Model T or A Ford. It's simple, strong, built to last. Use your old Ford or buy one cheap, and get the advantages of power farming.

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Use *The* EIFEL-GEARED PLIERENCH KIT

- 2 New Pocket Machine Shops . . 7″ and 8½″ . .
- It Takes 7 SQ. FT. OF SPACE and 101 Pictures to show the astounding Working Power, Speed and Efficiency, and the AMAZING MONEY-MAKING Power..$35 to $100 Weekly.. of this Greatest Hand Tool Invention of ALL Time . . so Don't expect us to tell the story Here; but . . let us send you the MOST AMAZING Propositions, FREE! . . They will Please and Astound you!
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Hundreds of paying businesses are being built with new 40 volt Simplified Arc Welding. New low prices make it available to shops that never before could afford it. Gets new paying jobs that carry a real profit. No pre-heating, no tanks to replace.

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Portable Welder with Hobart Generator unit and auto engine or chassis. Operates any place. Easily saves you $300 to $500.

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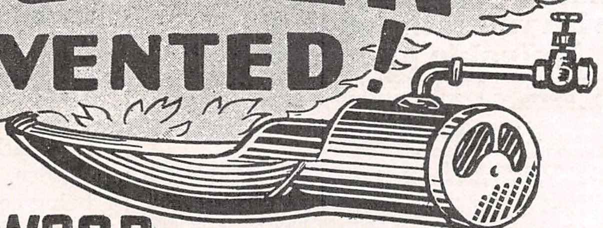
HOBART ONE OF THE WORLD'S LARGEST BUILDERS OF ARC WELDERS

Sweeping the Country!

New-TYPE CHEAP OIL BURNER INVENTED!

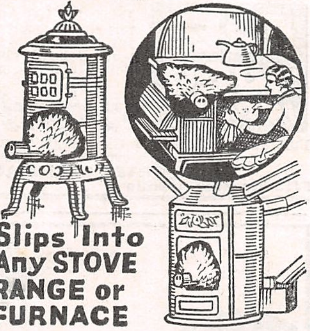


COOK and HEAT without COAL or WOOD

In Your Present Stove or Furnace

TWICE THE HEAT AT LESS COST—NO DIRT OR ASHES QUICK HEAT AT TURN OF VALVE

An Amazing New-Type Oil Burner Which Experts and 25,000 Users Say BEATS ANY EVER GOTTEN OUT FOR LOW COST, PERFECT PERFORMANCE, Burns Cheap Oil a NEW WAY Without Pre-generating or Clogging Up, Cuts Fuel Bills in Half and Pays for Itself Quickly by What It Saves. READ BELOW HOW YOU CAN TEST THIS REMARKABLE SUPER FLAME OIL BURNER in Your Own Home or Business FREE OF RISK. Then Mail Coupon.



Slips Into Any STOVE RANGE or FURNACE

—QUICK HEAT on or off AT TURN of VALVE

COOKS A MEAL for LESS

Why burn coal or wood with its dirt and drudgery of building and feeding fires? Why carry ashes and get uneven, slow-starting heat, when you can burn cheap oil a NEW WAY and get TWICE THE HEAT at LESS COST—and have QUICK HEAT regulated to any degree desired by a simple turn of a valve?

Your present coal or wood stove, heating stove or furnace can be fitted easily and quickly with our Super Flame "HEAT KING." Thousands have acclaimed it the most perfect oil burner. Nothing like it ever on the market—the lowest priced efficient oil burner—Positively guaranteed NOT TO CLOG, NOT TO CARBON OR STOP UP. The only oil burner that has a record of over 11 years constant use without ever needing any cleaning. Simple—safe—economical—no electrical connections—no moving parts to wear out—all unnecessary parts eliminated—does better work at less cost. Burns 95% air and 5% cheap oil and the result is TWICE THE HEAT OF COAL by simply turning valve. **What an Engineer of National Reputation Says:**

Combustion principles of the Heat King are simple, efficient, excellent—assures economical oil consumption and maximum amount of heat. Tests made on burner with one year's hard service prove there was no evidence of dirt or residue within the burner or any carbon deposit on any interior parts. There are no nozzles or tips to "coke up" or stop up with sediment, scale, etc.—C. W. Lovelace—K. C., Mo.

WHAT USERS SAY:

There are fifteen oil burners of different kinds here but Heat King is cheapest and best—J. R. Goldthorp—Washington.

I get more heat from your burner than I ever had from coal, wood or anything else I ever burned in my furnace—W. C. Nicholson—Ind.

My wife and her mother say they have reduced their coal bill fifty percent since they put your oil burner in—W. S. Collins, Pa.

Your oil burner is the poor man's friend—L. Gradner—N. C.

TRY AT OUR RISK—30 DAYS TRIAL

If you want to SAVE MONEY in cooking and heating you may try the "HEAT KING" AT OUR RISK—Prove that it ends drudgery and dirt of coal or wood, cuts fuel bills in half, pays for itself quickly by what it SAVES. You must be satisfied under our liberal guarantee or YOU PAY FOR THE BURNER ABSOLUTELY NOTHING.

FREE SAMPLE to Agents

and salesmen offered to one energetic man or woman in each locality who will demonstrate and take orders. Send no money—just sign and mail coupon (or 1c postcard will do). You can't lose for here's a revolutionary cheap new type oil burner that is safe, economical and efficient. So mail coupon quick, be first in your locality to learn how satisfactory oil heat can really be and how you can MAKE REAL MONEY spare or full time. Mail Coupon or 1c postcard today—NOW.

AGENTS SALESMEN DISTRIBUTORS— BIG MONEY

Startling low price puts this amazing new-type oil burner within the reach of everyone. No wonder so many homes, small business firms, oil filling stations, etc., are buying it—no wonder salesmen and distributors are breaking records in sales. All YOU have to do is to bring it to the attention of prospects and show how it gives QUICK HEAT, HOTTER, CHEAPER, WITHOUT DIRT AND ASHES, and how it quickly pays for itself by what IT SAVES—then, reap BIG CASH PROFITS. It sells fast because low-priced, cheap to operate, efficient.

WHAT SALESMEN SAY:

Greatly pleased with installations. Installed one when weather was 10 degrees below zero. Kept house well heated and owner is still raving about the wonderful burner. I can dispose of 250 "HEAT KINGS" before this year ends.—F. Silver—Canada.

Demand for oil burners is great. Have fifteen salesmen starting. Would like to turn out 200 burners a week—C. A. Pierce—N. Y.

Heat King satisfactory in demonstration to one of the largest oil companies—W. DeJeffers—Ohio.

I am a plumber, have installed all kinds of oil burners, but, I never knew before there was such a thing to get that much heat out of oil. There is money in selling them—W. C. Nicholson—Ind.

If you want to DOUBLE and TREBLE your earnings and own your own business, you can't beat the "HEAT KING" as a money maker. Get YOUR OWN OIL BURNER SAMPLE AT NO COST and CASH IN BIG PROFITS. Act quick—be FIRST in your locality—MAIL COUPON at right or 1c postcard today—NOW.

UNITED FACTORIES P-751 Factory Building Kansas City, Mo.

MAIL COUPON

UNITED FACTORIES, P-751 Factory Bldg.,
Kansas City, Mo.

Without cost or obligation, rush generous TRIAL OFFER on the wonderful "HEAT KING" Oil Burner sent WITHOUT RISK TO ME.

Name..

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with your own collection of
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The PORTER CHEMICAL COMPANY
5414 Prospect Avenue Hagerstown, Maryland

(Continued from page 162A)

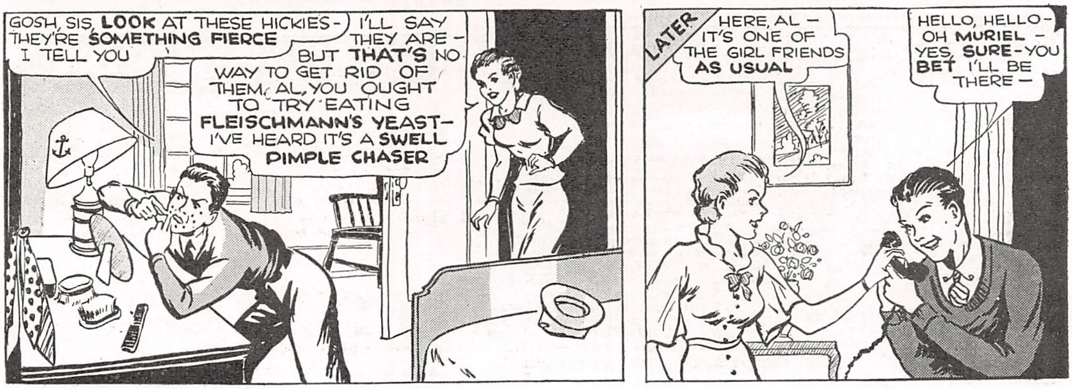
been able to start their flights with a maximum load without risking a takeoff from the open sea.

England is building a fleet of flying boats which may be placed in service on the great circle route sometime next summer. Imperial Airways, which maintains a vast system of air lines to the far-flung corners of the British Empire, is in charge of the construction, as well as training crews for transatlantic duty. Completion of this fleet is expected to mark inauguration of several test flights between Portsmouth or London and New York. On the outcome of the flights will depend the start of regular air travel between the two countries.

France, too, is beyond the point of toying with the dream of North Atlantic service. Huge ocean-going air liners are being constructed. One already has made a test flight, in easy stages, to this country by way of the Azores. From Paris to New York, the French planes would have the choice of the great circle course or the Azores-Bermuda route, leaving the coast of Europe at Lisbon.

During the summer England and France might be expected to fly passengers and

I'M FED UP WITH ALL THIS SOCIAL STUFF


GOSH, SIS, LOOK AT THESE HICKIES - THEY'RE SOMETHING FIERCE I TELL YOU
I'LL SAY THEY ARE - BUT THAT'S NO WAY TO GET RID OF THEM, AL, YOU OUGHT TO TRY EATING FLEISCHMANN'S YEAST - I'VE HEARD IT'S A SWELL PIMPLE CHASER
LATER
HERE, AL - IT'S ONE OF THE GIRL FRIENDS AS USUAL
HELLO, HELLO - OH MURIEL - YES, SURE - YOU BET I'LL BE THERE -

mail over the shortest route, but winter probably would cause both nations to use the Azores route.

Holland's plans for transatlantic service are not sufficiently advanced for announcement of the route which Dutch air liners might use, but some authorities believe the Azores would be considered most favorably, due to the safety factor and its year-round possibilities.

Just now Pan American Airways is busy with inauguration of passenger travel on its Pacific line, but the results obtained on test flights with big flying boats on the California-Manila route are expected to have some influence on plans for Atlantic service. Pan American would have the choice of the great circle or the Lindbergh routes in the north and the Azores route in the south. The idea of anchoring catapult ships, similar to those used by Lufthansa, off Ireland and off Newfoundland has been suggested by aviation experts as one possible aid to flying the northern route, but no tests have been made. Another suggestion is construction of floating airports in the Atlantic for the convenience of transatlantic planes.

"only the light type segment moves . . . and it goes down, not up!"

Have your dealer show you the famous "Floating Shift"—it's an *exclusive* Corona feature. Work it with your little finger—no effort, no noise, faster, more accurate. And it's only *one* of a dozen practical helps that Corona offers—and Corona only! New models now displayed everywhere.

CORONA floating Shift

CORONA STANDARD

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America's first . . . America's finest

Easily the best portable we have ever offered—and we've made nearly two million! Carrying case and free touch-typing lessons included with each machine. And easy terms, too—$1.00 a week takes a Corona home with you! Several models, several prices; mail the coupon for descriptive leaflet . . . free.

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I'm thinking of buying a Corona. Please send free booklet showing models and prices.

Name__________

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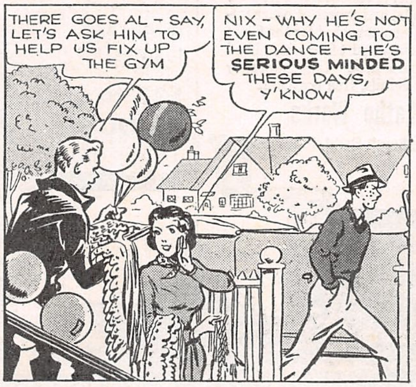
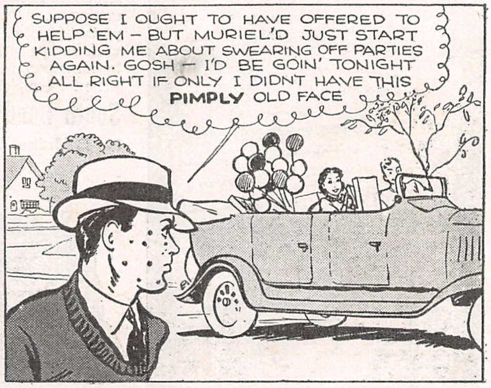
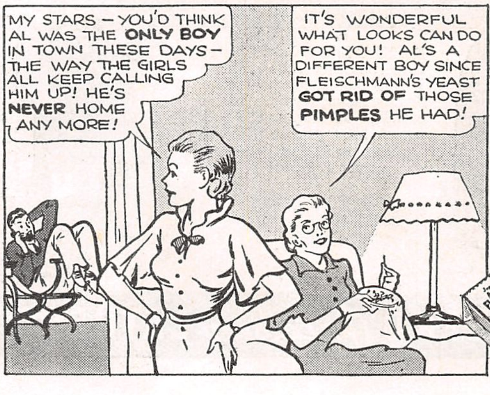
– BUT PIMPLES WERE THE REAL REASON AL SAID "NO" TO PARTIES


THERE GOES AL – SAY, LET'S ASK HIM TO HELP US FIX UP THE GYM
NIX – WHY HE'S NOT EVEN COMING TO THE DANCE – HE'S SERIOUS MINDED THESE DAYS, Y'KNOW


SUPPOSE I OUGHT TO HAVE OFFERED TO HELP 'EM – BUT MURIEL'D JUST START KIDDING ME ABOUT SWEARING OFF PARTIES AGAIN. GOSH – I'D BE GOIN' TONIGHT ALL RIGHT IF ONLY I DIDN'T HAVE THIS PIMPLY OLD FACE


MY STARS – YOU'D THINK AL WAS THE ONLY BOY IN TOWN THESE DAYS – THE WAY THE GIRLS ALL KEEP CALLING HIM UP! HE'S NEVER HOME ANY MORE!
IT'S WONDERFUL WHAT LOOKS CAN DO FOR YOU! AL'S A DIFFERENT BOY SINCE FLEISCHMANN'S YEAST GOT RID OF THOSE PIMPLES HE HAD!

Don't let Adolescent Pimples put a check on your good times

A pimply skin makes *any* boy or girl feel low spirited. Yet many young people have this trouble after the start of adolescence—from 13 to 25. At this time important glands develop. The whole body is disturbed. The skin gets oversensitive. Waste poisons in the blood irritate this sensitive skin—pimples break out.

Fleischmann's fresh Yeast clears these skin irritants out of the blood. Then, pimples go. Eat 3 cakes daily, one before each meal—plain, or in a little water—until your skin is perfectly clear.

FLEISCHMANN'S YEAST

—clears the skin

by clearing skin irritants out of the blood

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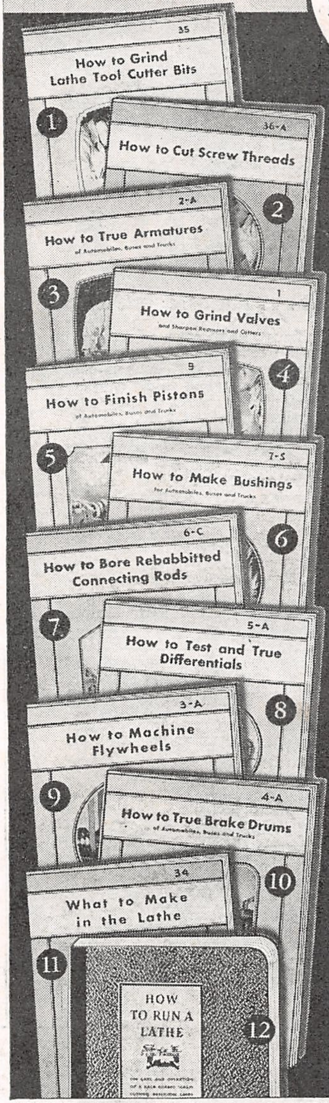
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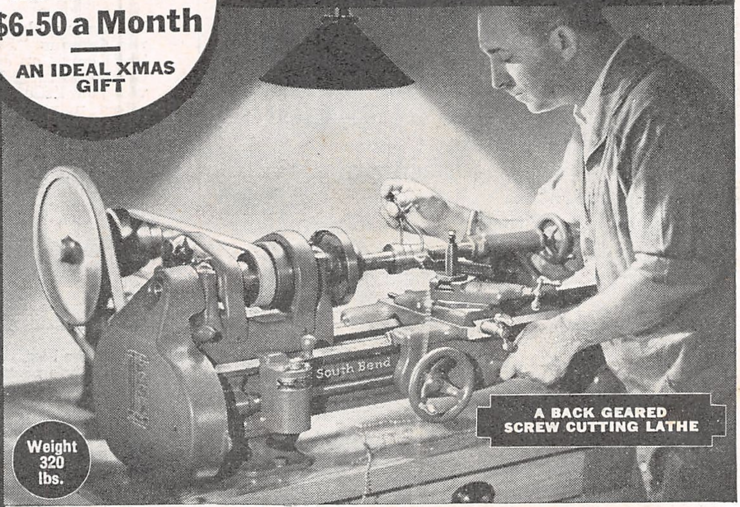
9" x 3' SOUTH BEND WORKSHOP LATHE


South Bend
Weight 320 lbs.
A BACK GEARED SCREW CUTTING LATHE

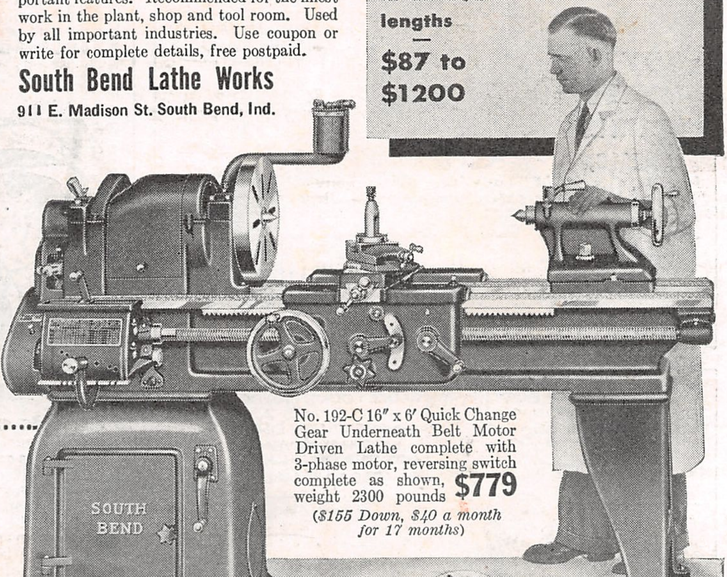
No. 415-YA 9⅛" swing by 3' bed Workshop Bench Lathe with Horizontal Motor Drive, ¼ H.P. Reversing Motor, Switch and belt tension countershaft as shown **$103.25**
($28 Down, $7 a month for 12 months)

A PRECISION LATHE

The New 9-inch Workshop Lathe is a Precision Lathe with Twin Gear reverse to leadscrew, Ball Thrust Bearing on Spindle, longitudinal screw feed to carriage, precision lead screw for cutting screw threads, and scores of other important features. Recommended for the finest work in the plant, shop and tool room. Used by all important industries. Use coupon or write for complete details, free postpaid.

South Bend Lathe Works
911 E. Madison St. South Bend, Ind.

5 OTHER SIZES
9"-11"-13"-15"-16" SWING
in all bed lengths
$87 to $1200



No. 192-C 16" x 6' Quick Change Gear Underneath Belt Motor Driven Lathe complete with 3-phase motor, reversing switch complete as shown, weight 2300 pounds **$779**
($155 Down, $40 a month for 17 months)

South Bend Lathe Works,
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SOUTH BEND *Precision* LATHES

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2 MONEY-MAKING METAL OUTFITS

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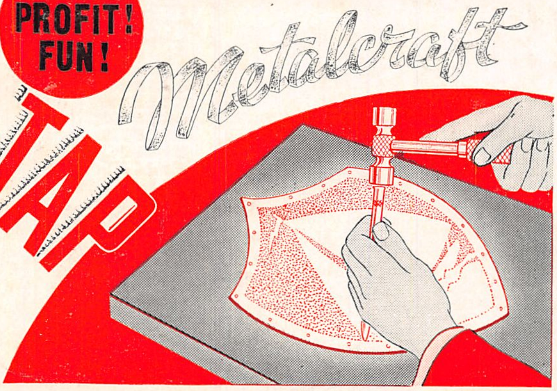

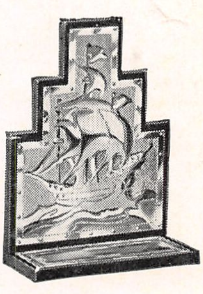

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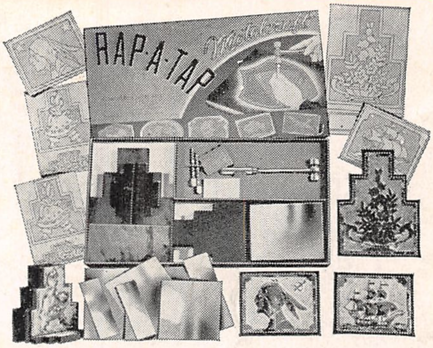

MAKE MONEY

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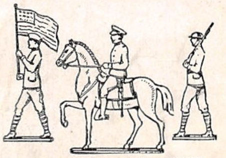

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